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the fighters



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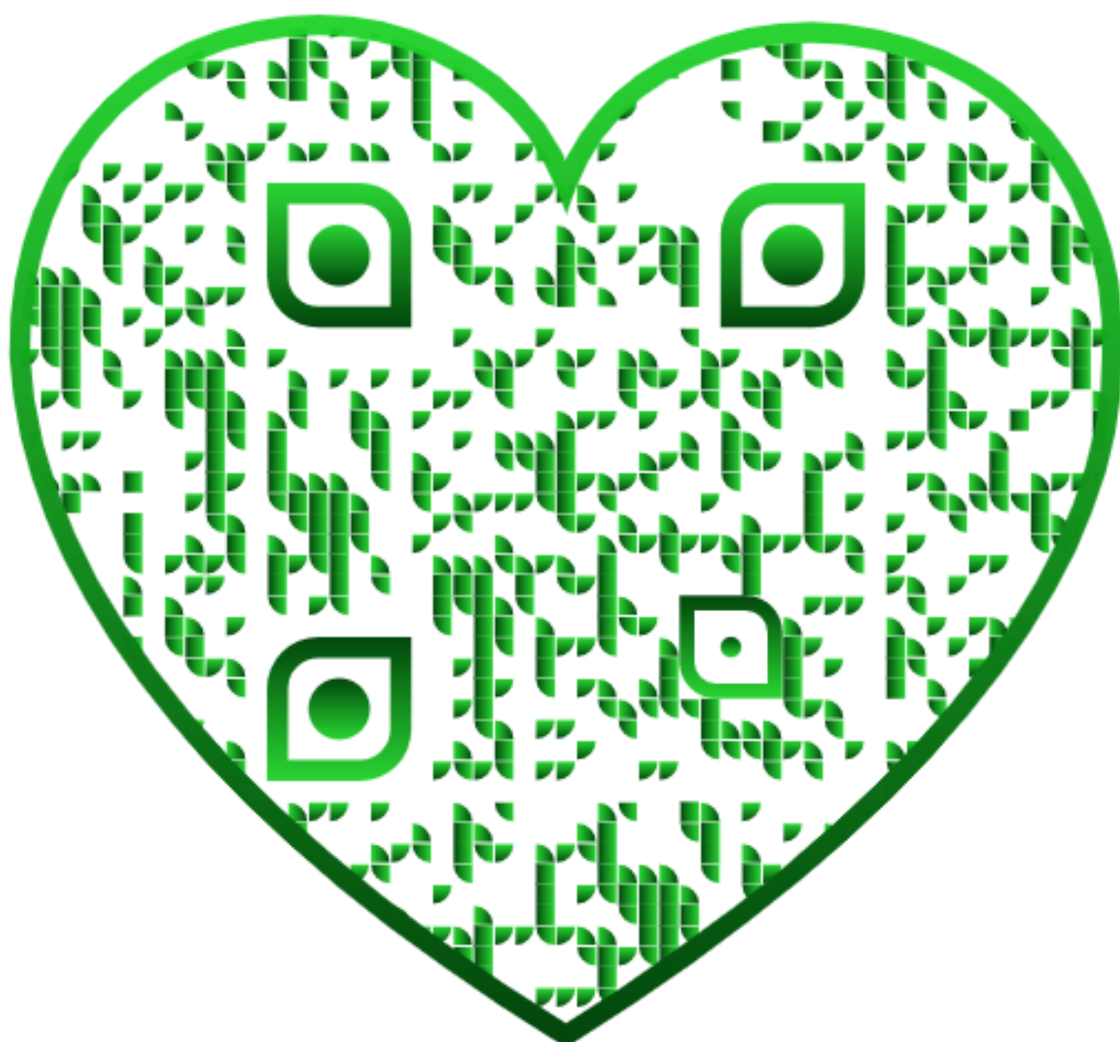
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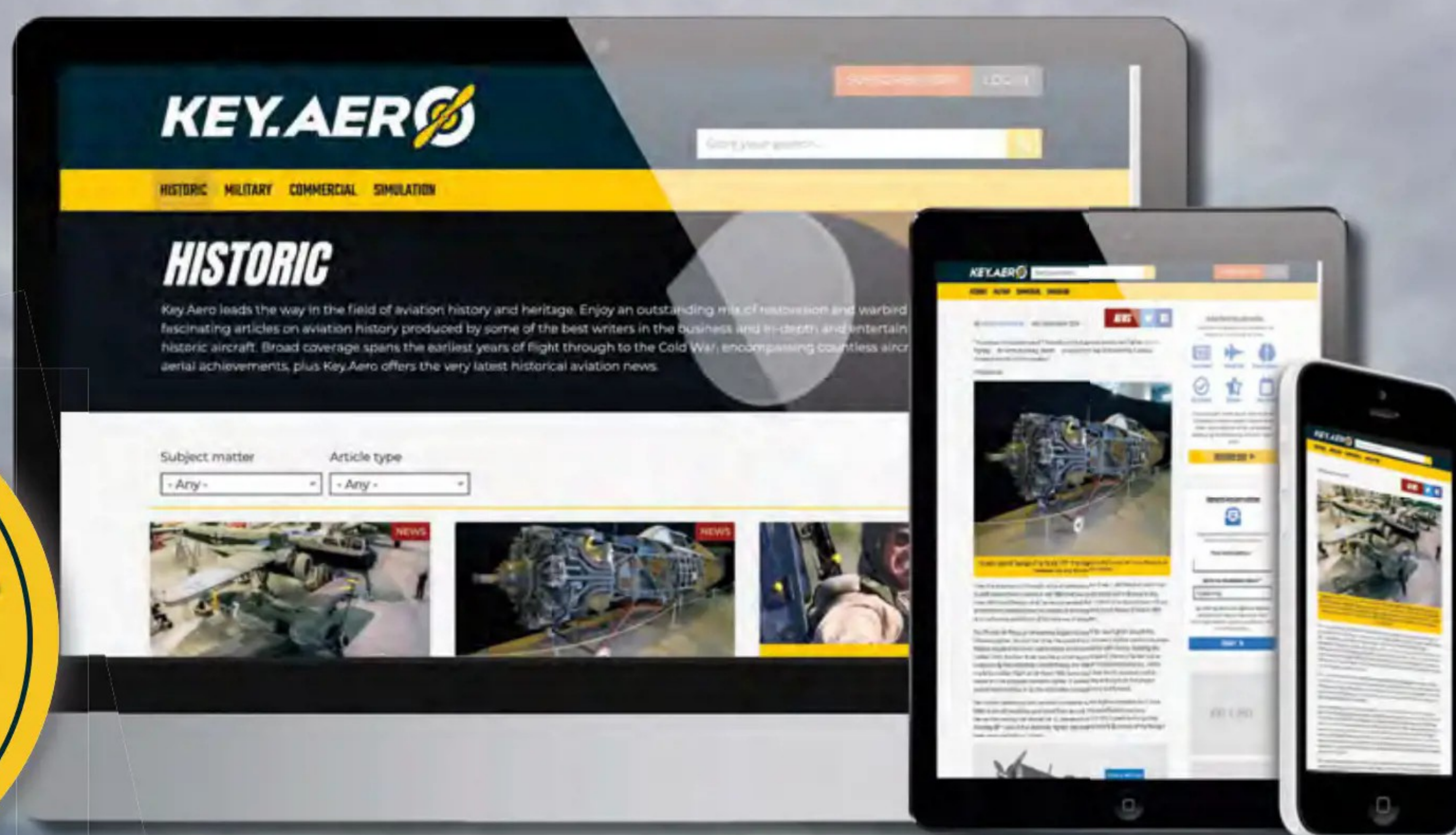
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Surely Putin has lost Syria?

After several years of stalemate in the Syrian civil war that started in 2011, the sudden ousting of President Bashar al-Assad in early December caught most of us by surprise – not least Assad himself.

As opposition forces led by Hay'at Tahrir al-Sham (HTS) advanced from Aleppo into Homs and then on to Damascus, it reminded me of how the Taliban had swept through Afghanistan in 2021. It just showed that you could have all the firepower in the world – and Syria certainly had that – but if the military do not stand resolute and remain up for the fight, no government will stand a chance, particularly if the struggle is based on religious ideology. Several countries in the Middle East region should take heed.

Assad's regime was being propped up by Vladimir Putin's military might in exchange for millions of dollars regularly airfreighted from Syria to Moscow in recent years. It might have been useful for funding Putin's war in Ukraine, if he didn't keep it all for himself. With the downfall of Assad and Israel's subsequent destruction of much

of his military aircraft and defence systems (see page 10-11), there will come a time when Syria has healed from the 13-year civil war and a new government will want to buy more military equipment. US President-elect Trump will undoubtedly be thinking about how he can leverage support for any new government in exchange for the purchase of new military equipment, just as the US did in Iraq and Afghanistan.

Defending itself from the many hostiles in the region – of which there are many – will be a top priority for Syria. It also goes without saying that Turkey's President Tayyip Erdogan, who supported the opposition in Syria, will remind any new government of his country's role and undoubtedly want a share of any defence contracts in return – Turkish arms manufacturers have a lot to offer these days. So Putin could lose a very big export customer of his military equipment, just as he did in Afghanistan, Iraq and Libya.

Another of Putin's major export markets, China, is also trying to wean itself from Russia's military

equipment, as we can see from our two-part report on the Zhuhai Airshow (see page 24), even if the countries do remain close allies.

Of course, there is always Iran. Putin must be hoping that the Islamic government doesn't fall from power, but surrounded by so many enemies and with Tehran's Axis of Resistance breaking up, who would bet against that happening?

Alan Warnes
Group Editor at Large



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Turkey's President Tayyip Erdogan will be anticipating some major defence contracts in return for the support he provided the Syrian resistance. Maybe a Hurjet or two for starters? Alan Warnes

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Next Issue
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Regulars

03 Comment

AirForces Monthly's regular editorial opinion about recent and noteworthy military aviation topics

06 News

• Headlines (p6) • UK (p10) • Europe (p12) • Spanish Navy Livefire Ex (p14) • North America (p18) • Kish Airshow (p20) • Latin America (p22) • Zhuhai Air Show (p24)

28 Just Passing Through

Ben Stanley Hall showcases the rich diversity of aircraft movements up and down the UK

40 Russia/Ukraine War: Ukraine Air War – Three years on

As we approach the three-year anniversary of Russia's invasion of Ukraine, Tim Ripley looks at how the air war between Russia and Ukraine has evolved dramatically with new

weapons and tactics being employed by both sides

70 Exercise Report: Gunning for glory

The 6th edition of the Baccarat exercise was held in the Grand East region of France last October, conducted in a highly realistic environment, involving approximately 1,000 military personnel, 30 helicopters, and 260 vehicles, including 21 armoured vehicles. François Nôtre reports

80 Exercise Report: Battle over Brazil

Latin America's largest simulated air exercise took centre stage for two weeks in November at Natal Air Base in Brazil. Giovanni Colla reports

88 Showbiz: Belgian Flair

The small airstrip at Leopoldsborg in rural

Belgium is an unlikely setting for one of Europe's largest airshows. Yet, since 1977 this relatively unassuming location has played host to one of the continent's best-loved aviation events. Gordon Duncan reports back from Limburg Province

90 Showbiz: Glorious Gifu

The Japan Air Self-Defense Force staged the Gifu Air Base Air Festival 2024 at Kakamigahara in November. Junji Sato reports back

95 Attrition Report

AFM's Dave Allport provides details of the most significant recent military aviation mishaps from around the world

98 Next Issue

A preview of what's on the modern military aviation agenda in the January 2025 issue of *AirForces Monthly*

KF-21 dual-seat prototype #6, which had its first flight in June 2023 KAI



Features

30 Mildenhall matters

It's been a busy year at RAF Mildenhall as Bob Archer explains in his review of 2024

44 Korean Hawk ready to fly

Mina Adel takes an in-depth look at Korea Aerospace Industries' KF-21 'Boramae' as the Indigenous fifth-generation jet prepares to enter service

50 Watching the waves

Covering Canada's Northern territories, Eastern seaboard and beyond, Chris Melaisi and Stewart Marshall spend time with the courageous 'Tusker' crews who are on

constant alert to watch the waves and save Canadians in distress

58 Riding the whirlwind

The Tornado was the Luftwaffe's most numerous aircraft from the early 1980s. Today, just two wings remain, and these are due to be phased out by 2030. Kevin Wright talks with Tornado aircrew from both units

64 Last of the gunfighters

Patrick Roegies, Paul Gross and Ben Gorski spoke to *Major Sky* 'COMET' Lesh, of the 47th Fighter Squadron 'Dogpatchers', to assess the purpose,

necessity and objectives of the last Exercise Hawgsmoke

74 At the 'sharp end' for half a century

Former South African Air Force Commandant Neall Ellis, a British national, is now the world's longest still-active mercenary pilot. Al Venter details his extraordinary career flying helicopter gunships

92 End of a dream

Babak Taghvaei reports on the bad ending for Iran's last attempt to build an indigenous training jet

Main: A unique formation with all the participants of Exercise CRUZEX 2024 flying over Natal Air Base Giovanni Colla

Cover: An A-10C Thunderbolt, from the 76th Fighter Squadron 'Vanguards', banks away from a tanker after refuelling. The 'Wharthog' was refuelled several times during its transition flight to Davis-Monthan Air Force Base Jason Wong



Israel smash Syrian targets



F-15A-18-MC Ba'az multirole fighter of the IASF's 133 Squadron armed with three GBU-31 joint direct attack munitions prior to one of the missions of Operation Arrow of Bashan on December 9 Israeli Air and Space Force

WITHIN HOURS of the end of Bashar al-Assad's rule in Syria, the Israeli military struck strategic and tactical sites across the country to prevent weapons falling into the hands of insurgents, writes Babak Taghvaei.

Just a day after the end of Operation Northern Arrow by the Israeli Defence Force (IDF) against the Hezbollah organization in Lebanon, the Turkish government gave the green light to various militia groups, mostly linked to Al-Qaeda, to launch an assault on the Syrian regime.

Using advanced weaponry such as suicide drones, these groups, mainly led by Harakat Tahrir Al-Sham (HTS) and the Syrian National Army (SNA), took over half of Aleppo on November 29. It did not take long until they captured Hama, Homs and, finally, Damascus, bringing an end to the Assad family's tyrannical regime on December 8. Just two

hours after the fall of the regime, the Israeli government authorized the IDF to launch its largest operation in history to destroy all advanced weapons left by the Syrian Armed Forces.

Leaders of the insurgents involved in overthrowing Assad's regime had announced that they would soon launch a war on Israel to conquer Jerusalem. In response, Operation Arrow of Bashan was set into motion by the Israeli Air and Space Force (IASF) and Navy to destroy the majority of operational fighter jets, attack helicopters, air defence systems, ballistic missiles and navy vessels left by the Syrian Armed Forces to prevent their future use against Israel. In addition to these strikes, the IDF's infantry, armoured and airborne special operations units entered southern Syria to create a buffer zone to prevent Al-Qaeda-affiliated groups from using these areas to

wage war on Israel and its people.

Capture of military sites

On November 29, the Syrian Scientific Studies and Research Center (SSRC) in Al-Safira, southern Aleppo, was

captured by the HTS. A few days later, the largest ballistic missile base of the Syrian Arab Army, home to hundreds of Scud B, Fateh 110 (Tashrin) and Luna M heavy rockets was captured by the insurgents. As the Syrian regime had used the SSRC

to develop chemical and microbiological agents for embedding in ballistic missile warheads, the Israeli government saw its capture by the groups as a threat to Israel.

The Israeli government notified the IDF to prepare for possible pre-emptive

In the early hours of December 9, one of the Sa'ar 4.5-class missile boats of the Israeli Navy used Spike NLOS surface-to-surface missiles to target 15 vessels of the Syrian Arab Navy in Latakia's two ports Babak Taghvaei



airstrikes at the SSRC at Al-Safira in order to deny the insurgents from having access to the means for production of weapons of mass destruction. This did not take place until December 9, a day after the fall of Assad's regime, destroying the research laboratories and many other important SSRC facilities. A similar airstrike was conducted on the same day at a Syrian MOD research centre near Damascus.

In addition, the insurgents captured two key air bases of the Syrian Arab Air Force (SyAAF), Hama and Kuweires, followed by Aleppo International Airport. These bases housed advanced air-defence systems such as the Pantsir S1E short-range surface-to-air missile system. Operational combat aircraft and helicopters left by the SyAADF and the SyAAF in these air bases included seven L-39ZA and four L-39ZO combat trainers, MiG-21bis fighter jets and Mi-8T utility helicopters.

Operation Arrow of Bashan

On the afternoon of December 8, the IASF launched Operation Arrow

of Bashan to destroy the heavy and strategic military equipment and weapons in various military sites and bases across Syria. The first wave of the airstrikes focused on destruction of all the components of the surface-to-air missile systems. For example, in Al-Mezzeh airbase, Damascus, the components of a complete Kub/SA-6 Gainful medium-range SAM battery was destroyed. All SyAADF Pantsir S1Es scattered in Damascus International airport and the surrounding streets and highways were also targeted.

During the second phase that began after sunset, the IASF targetted airworthy fighter jets, tactical bombers and helicopters across the country. Images and videos taken by the local news media showed destruction of the last four airworthy Aerospatiale SA342L Gazelle anti-tank helicopters of the 976th and 977th Helicopter Squadrons in Al-Mezzeh (1307, 1310, 1313 and 1316) and all the airworthy MiG-23ML fighter-interceptors of the SyAAF's 945th Fighter Squadron and Su-22M3/M4 tactical bombers

All IASF F-16Ds based in Ramat David were dedicated to the airstrikes in support of the IDF Northern Command's activities on December 8 and 9, including this example from 109 Squadron 'The Valley' Babak Taghvaei



of the 54th Fighter Squadron in Khalkhalah,

Meanwhile, the Israeli Navy destroyed most of the vessels of the Syrian Arab Navy in Minet Al-Bayda and Latakia ports. In the former, five Tir class fast boats armed with C-802 anti-ship missiles were targeted, while in the latter, nine Osa I/II missile boats and a Petya III class-frigate were struck. Spike NLOS anti-tank missiles were launched from a Sa'ar 4.5-class missile boat, INS *Hetz*.

According to the IDF, IASF fighter jets flew hundreds of hours over Syrian airspace, conducting more than 350 airstrikes. Numerous strategic weapons were neutralized, including Scud missiles, cruise missiles, surface-to-sea, surface-to-air and surface-to-surface missiles, UAVs, fighter jets, attack helicopters, radars, tanks, hangars and more. Most of these attacks utilised F-15I Ra'am strike fighters of the IASF's 69 'Hammer' Squadron flown from Hatzirim, along with F-15A/B/C/D

Ba'az multirole fighter jets of 106 Squadron 'The Point of the Spear' and 133 Squadron 'Knights of the Twin Tail' flown from Tel Nof.

The Northern Command's Fire Control Centre conducted airstrikes on 130 assets in Syria, including weapons depots, military structures, launchers and firing positions. They used Hermes 450 Zik armed drones as well as F-16D multirole fighter jets of 105 Squadron 'Scorpions' and 109 Squadron 'The Valley' flown from Ramat David AB in northern Israel.

The jets also provided air support for the IDF's 5101st Unit (Sayeret Shaldag) which entered Syrian territory in the early hours of December 9 and, alongside multiple IDF infantry and armoured units, took over territories in southern Syria including Quneytra and established a buffer zone to prevent HTS and other groups from using them as a base to attack Israel.

Despite Turkey's condemnation, the local population in southern Syria, particularly the Druze religious and ethnic minorities, welcomed Israeli rule as they feared attacks by Turkish backed extremist groups.

The IASF's airstrikes at the weapon and ammunition depots now under control of the Islamic extremist groups in Syria, continued for days. In the early hours of December 16, a missile base near Tartus was targeted by the IASF. A day after the first airstrike, a second was conducted against the missile base, destroying several bunkers where tens of ballistic missiles had been stored. At the same time, the IASF targeted another missile base near the city of Al-Qalamoun.

This Ilyushin Il-76T heavy transport aircraft of the SyAAF's 575th Squadron was used for Bashar Al-Assad's defection from Damascus to Hmeimim AB on December 8 Babak Taghvaei



USAF strikes Islamic State

THE USAF launched a string of airstrikes using B-52s, F-15Es and A-10s targeting Islamic State (ISIS) terrorists in Syria following the fall of the Assad regime at the start of December.

The sudden takeover by Al-Qaeda affiliated terrorist groups, including the Tahrir Al-Sham organization, led to the release of thousands of ISIS members from prisons across Syria, allowing the group to regain power in the region. The Kurdish-led Syrian Democratic Forces (SDF), a crucial partner of the Combined Joint Task Force Operation Inherent Resolve (CJTF-OIR), came under attack by Turkish-controlled Islamist groups, halting their anti-ISIS operations.

The resurgence of ISIS in Syria, coupled with the SDF's inability to combat

them effectively, resulted in a significant increase in combat operations by the USAF fighter and bomber squadrons in the Central Command (CENTCOM) area of responsibility (AOR). Forty-eight fighter jets from four squadrons, along with six B-52H bombers, conducted numerous airstrikes targeting not only ISIS, but also various Al-Qaeda affiliated groups that posed a threat to US Army Special Operation Forces and Rangers in Syria.

Flying Tigers ***A-10Cs in action***

Aleppo in the north of Syria was occupied by Al-Qaeda affiliated groups between November 29 and December 2, 2024. In response to this, the Iraqi government decided to deploy its army and

Popular Mobilization Forces (PMU) to the borders with Syria. Some of the brigades of the PMU with a close relationship with the Islamic Revolutionary Guard Corps Quds Force (IRGC-QF) entered Syria and were deployed to Deir Ez-Zor.

The IRGC affiliated factions of the PMU

launched unguided rockets and mortar at the US Army troops at 'Green Village' and other military camps near the gas and oil facilities of Deir Ez-Zor on December 3. In response to these actions, the USAF's 74th EFS used a fleet of 12 A-10C+ Thunderbolt II ground attack aircraft from

Al-Dhafra AB to provide close-air-support (CAS), preventing the PMU from attacking the US military camps and outposts.

The A-10Cs destroyed three truck-mounted multiple rocket launchers, a T-64 tank, an armoured personnel carrier and mortar positions that presented a threat to



The A-10Cs of the USAF's 74th EFS used their massive GAU-8/A Avenger Gatling gun to strafe and destroy PMU targets in Deir Ez-zor on December 3, 2024
USAF/TSgt Devin Boyer



The 389th FS based at Mountain Home AFB has had 12 of its F-15Es on deployment at Muwaffaq Al-Salti AB since October 2024. These aircraft became heavily involved in combat air patrols to protect US and Israeli forces in Iraq, Syria and Jordan USAF/SSgt Gerald Willis



One of 12 F-15Es of the USAF's 492nd EFS currently on deployment at Muwaffaq Al-Salti AB Babak Taghvaei

Operation Days of Repentance, against targets in Iran. As the Iranian regime threatened to retaliate, the USAF deployed six B-52Hs to Qatar. Operated by the Minot AFB-based 69th BS 'Knights', the aircraft began arriving at Al-Udeid AB on November 2. These aircraft were then used by AFCENT to deal with the threat of ISIS in central Syria following the fall of Assad's regime in December 2024.

Most airstrikes conducted against ISIS were carried out by the six B-52Hs deployed at Al-Udeid AB. Capt Megan Morrissey, head of public affairs at AFCENT, said: "The B-52 is an iconic and internationally recognized symbol of credible combat power that has persisted for generations. The B-52, its warfighting operators and support professionals provide numerous flexible strategic options to US senior leaders by employing large payloads over long ranges and an exceptionally wide range of precision munitions for long-range strike or direct attack capable of deterring, denying or defeating any adversary threat."

Since early October 2024, the USAF has had its KC-46As involved in AFCENT's AOR, deploying six of them to Al-Udeid AB. These heavy tankers have supported the B-52H's operations over Syria.



A total of six B-52Hs were deployed to Al-Udeid AB, Qatar, by the 5th BW to counter the threat of Iran's retaliatory airstrike at Israel in November 2024 USAF/Staff Sgt Gerald Willis

and its SDF. In several cases, the rioters tried to attack prisons to release thousands of ISIS members held in them. The withdrawal of the last US Army troops from Syria to appease the Turkish government might not only lead to the release of terrorists from AANES prisons but also thousands of ISIS members and their families in the Al-Hol camp.

On December 16 and 18, 2024, the 12 F-15Es of the 492nd EFS were redeployed back to RAF Lakenheath, leaving the AFCENT with only 36 fighter jets in the CENTCOM's AOR.

Knights' B-52Hs in action

On October 26, the Israeli Air and Space Force (IASF) conducted



The USAF's three U-2S Dragon Lady spy planes on deployment in Eastern Europe fly over Syria on photo reconnaissance missions to detect newly established camps of ISIS in central Syria Babak Taghvaei

The F-16CMs of the USAF's 480th FS on deployment at the Prince Sultan Air Base in Saudi Arabia Babak Taghvaei



US and coalition forces. The self-defence strike occurred after rockets and mortars were fired toward US forces.

Rise of ISIS in Syria

While the Israelis took drastic measures against Al-Qaeda-affiliated groups in Syria, American forces held back from launching similar actions in deference to the Turkish government. This put heavy pressure on the Air Force Central (AFCENT) to compensate for the lack of enough ground forces in Syria to battle ISIS by increasing the intensity and number of airstrikes on ISIS and other Al-Qaeda-affiliated groups.

On the same day that the Assad regime fell, AFCENT conducted dozens of precision airstrikes in Syria, targeting known ISIS camps and operatives in central regions of the country. The operation struck more than 75

targets using multiple USAF assets, including 24 F-15Es of the 389th and 492nd EFSs from the 366th and 48th FWs, 12 F-16CM Block 50s of the 480th EFS from the 52nd FW and six B-52Hs of the 69th BS (Bomb Squadron), a subordination of the 5th BW (Bomb Wing).

"There should be no doubt: we will not allow ISIS to reconstitute and take advantage of the current situation in Syria," said General Michael Erik Kurilla. "All organizations in Syria should know that we will hold them accountable if they partner with or support ISIS in any way."

As the days passed, ISIS gradually increased its power in Syria. ISIS sympathizers in the Kurdish cities of Hasakah and Raqqah began protesting and even rioting against the US-backed Autonomous Administration of North and East Syria (AANES)

RAF Typhoons land in Turkey

TWO RAF Typhoon fighters are understood to have landed in Turkey for "inspection" by its defence ministry as the nation considers a bid to buy up to 40 Eurofighters. The visit, which was

due to have taken place on December 18, was revealed by Turkish Defence Minister Yaşar Güler in a television interview during which he described ongoing negotiations

over the fighter jets as "progressing positively". He said: "These two Typhoons, currently participating in training exercises in Qatar, will be inspected upon their arrival in Ankara."

While the jets remain under the operational control of the RAF, their arrival marks a key moment in Turkey's exploratory talks with the Eurofighter consortium, which includes the UK,

Germany, Spain, and Italy. Until this year Turkey had been barred from buying Eurofighters due to a veto by Germany but, following high-level negotiations it is understood that the objection had been lifted.

Excalibur tests future fighter systems

THE first phase of flight tests by the Excalibur Flight Test Aircraft (FTA) have been successfully completed at QinetiQ's Boscombe Down facility in Wiltshire.

The Ministry of Defence, along with partners Leonardo and 2Excel said the milestone, announced on December 9, saw Excalibur assessed for stability during flight. The aircraft will now undergo further engineering work.

The aircraft is a former commercial Boeing 757 aircraft that is being overhauled into a flying laboratory for combat air technology. It is part of

the UK's Future Combat Air System (FCAS), which will include the core fighter being developed under the Global Combat Air Programme (GCAP), as well as a broader range of capabilities including uncrewed aircraft, information systems and weapon systems.

The first phase of modification saw the Excalibur FTA equipped with new side and belly pods, changing the outer mould line of the aircraft. These pods are designed to host the Integrated Sensors, Non-Kinetic Effects (ISANKE) and Integrated



The Excalibur fitted with new side and belly pods takes off from Boscombe Down Leonardo

Communications Systems (ICS) that Leonardo UK and its international partners

are developing as part of their work on GCAP. Further modification to the aircraft will include

a fighter jet-style nose cone, to host advanced radar-based sensor demonstrators.

Lossiemouth Poseidons used to train Canada crew

INSTRUCTORS from RAF Lossiemouth's 42 (Torpedo Bomber) Squadron have begun training Royal Canadian Air Force crews to operate the MRA1 (P-8A) Poseidon maritime patrol aircraft.

This is in preparation for the Royal Canadian Air Force receiving their first Poseidon. For several months, RAF personnel have welcomed aircrew from the Royal Canadian Air Force to share their skills and experience

working with the aircraft. On December 10, the four Canadian personnel undertook their first flights with the P-8A after several months of training at Lossiemouth. This is the first flying phase of the Royal Canadian Air

Force's integration into the UK Poseidon force. These training flights allowed the Canadian pilots to understand the role of maritime protection in keeping the UK's seas and skies secure, as well as gaining experience of

the technical aspects of the P-8A aircraft. Flights took them across the UK, leading to an increased presence of the Poseidon aircraft in areas where they are not often seen, particularly around England.



The RAF and Canadian crew of the first training mission at RAF Lossiemouth MOD/Crown Copyright

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Croatia sees last MiG-21s QRA



The last Croatian Air Force MiG-21bisD returns to Pleso after its last QRA mission on November 30
Chris Lofting

THE LAST remaining Croatian Air Force (CroAF) MiG-21 *Fishbed* fighter aircraft concluded Quick Reaction Alert (QRA) duty at sunset (1613hrs local time) on November 30 last year at its home base – Franjo Tudman International Airport near Zagreb, also known as Pleso.

This marked the end of the type's long and successful active military service in Europe lasting more than 63 years – the original version entering

service with former Warsaw Pact air forces in 1961.

The aircraft in question was a 47-year-old former Soviet upgraded MiG-21bisD (CroAF serial 116, callsign 'KNIGHT 01') of the local 191st Fighter Squadron (191.ELA), pictured here returning to Pleso from its final training ('Tango') QRA scramble performed on November 26 against a CroAF Rafale.

As it has flight airframe hours until the end of

April, it will continue being used for flying training until then".

Nonetheless, the days are numbered for this Cold War icon.

The MiG-21 was originally planned to retire from CroAF active duty by early 2024, but because four of the six remaining aircraft still had resources at least by the end of 2024, it was decided to keep them in service – including on QRA duty.

The last real scramble was conducted on July

21 against a civilian Piper PA-24-260 that failed to communicate with ground control.

The unit's personnel are now training on second-hand former French Rafale F3-R multi-role fighters, acquired as part of the €999m deal signed on November 21, 2021. A total of 12 aircraft (ten single-seat Rafale C and two two-seat Rafale B) should arrive by the end of April, with Initial Operational Capability (IOC) expected to be

reached by the year's end.

Deliveries began last year and by December a total of eight Rafales arrived – six on April 25, one on November 21 and one on December 11.

In order not to interfere with the unit's training activities, as of December 1 all air policing tasks over Croatia are being temporarily handled by the air forces of neighbouring Hungary and by Italy.

Vladimir Trendafilovski

First Polish Husarz makes first flight

The Polish 'Husarz' (AZ-02; c/n 3502) completed its first test flight from Lockheed Martin on December 2, 2024, **writes Victoria Fontana**. The flight began just after 1330hrs local time and lasted a little over an hour. Providing chase for this milestone was another F-35A from the Alabama ANG (AF-427; c/n 5727). This first test flight comes just over three months after the Lockheed Martin rollout

ceremony for the Polish Government.

A second Polish 'Husarz' (AZ-01; c/n 3501) completed its maiden flight from Lockheed Martin on December 3, 2024. The flight took off just after 1330hrs local time and lasted slightly over one-and-a-half hours. Providing chase for this flight was the first Polish 'Husarz' (AZ-02). This milestone marks two Polish Air Force aircraft currently undergoing flight testing at Lockheed

The second Polish Husarz AZ-01 on its maiden flight on December 3, 2024
Victoria Fontana



Martin's Air Force Plant 4 in Fort Worth, Texas.

Poland will receive 32 F-35As, with the first six aircraft scheduled

for delivery to Ebbing Air National Guard Base in Arkansas. Poland is set to become the first international operator

to conduct F-35 pilot training at this facility. The first F-35s are expected to arrive in Poland by 2026.

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Cobras strike

Frequently deployed around the world, the Spanish Armada's 9th Escuadrilla requires its personnel and fleet of Harrier II's to always be ready for the challenge ahead. **Chris Melaisi** looks at an important aspect of this preparation – air-ground assault training



With the unique background of the 'badlands' landscape, AV-8B+, VA.1B-35/'01-923', 'COBRA 53' performs the steep climb out after a 'pop-up' attack on the Bardenas firing range. All images Chris Melaisi unless stated

WITH A NATO deployment in early 2025, the Spanish Navy's AV-8B+ Cobra crews must train and more importantly, qualify in an air-to-ground assault course before being able to deploy to sea for an extended period.

Based at Rota Naval Base, located on Spain's southwest coast, 14km northwest of Cadiz, the 9ª Escuadrilla Aeronaves (9th Aircraft Squadron) of the Spanish Armada (Navy) is the only fixed wing fighter and attack squadron of the Aircraft Flotilla and Navy (FLOAN). Playing a key role in the country's defence, the squadron provides a unique capability, being the only embarkable fixed-wing asset in the Armada, which can be deployed at short notice on-board the country's aircraft carrier. *Juan Carlos I* (L61) is a multi-purpose amphibious assault ship-aircraft carrier, the only one of its kind in the Armada Española. Similar in role to many aircraft carriers, the amphibious landing ship has a ski jump for STOVL (Short Take-off and Vertical Landing) operations and is equipped with McDonnell

Douglas (T)AV-8B+ Harrier IIs, amongst rotary assets for search and rescue, transport and anti-submarine warfare. The squadron has accrued over 50,000 flying hours and makes Spain one of only a select group of nations to have embarked fixed wing aviation on its vessels.

The squadron's home at Rota Naval Base, provides them with a prime location for embarking on the *Juan Carlos I*. This location also allows easy and quick access to the training areas in the Gulf of Cádiz, the D-123 training area and to the Strait of Gibraltar and Sierra del Retín. The squadron is made up of 12 AV-8B+ Harrier II (known within

the Armada as 'Cobra') and 1 TAV-8B for training purposes. The Armada's Harrier II's provide unique capabilities to the Flotilla including the following: Intelligence, Surveillance, and Reconnaissance (ISR), Combat Search and Rescue (CSAR), Combat Air Patrol (CAP) in defence of the Naval Force, armed reconnaissance and attacks against designated naval and land targets and perform Close Air Support (CAS) in support of a force deployed on the ground. The squadron maintain the ability to conduct missions aboard aircraft carriers and other air-capable vessels, as well as from forward operating bases.

AV-8 pilot, Lt Bayo described flying the Harrier

as a rewarding experience and offered this insight into flying the aircraft, its future and the mission ahead. "It's one of the few jets that isn't fly-by-wire, so you can really feel the controls as if you were linked to it; very few military pilots can say that today. It's very responsive at low altitude due to its sizeable intake, which allows it to take in huge amounts of air, this is helpful when training at low altitude here on the firing range. I compare it to a mountain bike with a thick tyre, it's very stable and handles well in tough conditions.

He continued: "We are currently in a period of transition, in which everything is changing fast, but as of today, the



9th Squadron will continue to fly the AV-8B+ until at least 2030. The last modifications and updates for the aircraft will be in 2028. The USMC Harriers are being extended until 2028, so once the Joint Program Office (JPO) is over, our jets will be harder to maintain when the manufacturers stop producing spares. The replacement has not been confirmed yet, but the F-35 is the only suitable alternative for our carrier. Our up-coming deployment

'COBRA 55' taxiing out to the active runway for a mid-morning bombing run on the range. Three Mk.76 training bombs can be seen housed on the pylon





'COBRA 59' at Zaragoza ahead of departure to the range. Here AV-8B+ VA.1B-24/'01-914' is seen in a clean configuration, with just a TPOD and cannon for this mission



*A 9Esc pilot in the cockpit at Zaragoza, preparing for his mission to the range
Stewart Marshall*

will be 'Dedalo-25' where we will be part of a NATO Readiness Initiative, operating in the Mediterranean."

On the range

During November 2024, 9 Squadron made the short trip north to Zaragoza with 6 AV-8B+ and 1 TAV-8B, for a training deployment where crews could practice and be evaluated on the nearby live firing range in the Bardenas region.

With an up-coming NATO deployment, it is important that all pilots are skills-assessed within the air-to-ground role.

Being a realistic scenario training, the main task of the biannual trip is to train and be assessed on live munitions dropping at the Bardenas Firing Range. The range is located approximately 40 miles northwest from the temporary, forward operating base at Zaragoza. The squadron fully utilises their time, flying up to five sorties per day in a mixture of

two, three and four ship formations. The sole flying twin-stick (TAV-8B) in the Spanish inventory is also deployed, where a pilot can be assessed, or junior pilots can fly with an instructor. The TAV-8B is disadvantaged compared to the single seat AV-8B+ when flying combat missions; it doesn't possess the same capabilities, such as the use of a targeting pod, it has fewer stations on the wings for ordnance and is limited to day-attack missions only.

Becoming qualified in the air-to-ground mission involves dropping an array of live ordnance on targets, as well as 'dummy' Mark 76 and LGT (Laser Guided Training) bombs. Pilots perform LGTR (Laser Guided Tracking Runs), using the laser-guided munitions with a targeting pod or with guidance from personnel on the ground. A Forward Ground Controller or JTAC (Joint Terminal Attack Controller) is in place on the range, which

allows pilots to practice the CAS role. During each day, a pilot of the 9th Squadron will travel to the range and be a 'person on the ground' to aid the Air Force JTAC. This assists the Armada pilots with their targeting, as they can receive accurate data and live information from their squadron colleague on the ground, via radio.

Lieutenant Perez, a 9^a Escuadrilla AV-8 pilot, explained: "Almost the entire squadron is involved in this task; most of the pilots will attend, as well as many maintenance and support staff. During our time on the range, we will drop or launch a munition at a ground target. The angle and height we fly towards the target at, is all pre-determined during the pre-flight briefing. We perform several different tactics, in order to experience and be qualified in different scenarios. These include high-level dive deliveries and FL200, straight-level guided deliveries. We also perform low level tactics,

as well as 'pop-up' attacks, which consist of flying low, below radar, before climbing sharply and diving down on the target. We regularly perform low-light and night flying, using our night vision goggles and the air-to-ground radar, to assist us in locating the target on the range. Some flights are flown without ordnance on the pylons, and we focus primarily on using the 25mm Gatling cannon. There is an observation deck at the range, from where feedback will be provided. This allows the pilot to know if the drop has been successful and understand how accurate their drop has been. We are also able to see how effective the drop has been from the cockpit after climbing, post-drop and observing the hit. When we use the targeting pod, we can see exactly where the munition has hit via on-screen data, usually it's a very accurate strike. Most of our missions are air-to-ground focussed; this exercise at Zaragoza

will help us all for the up-coming deployment, during which we may train and carry out air-to-ground attack. The exercise allows us to be qualified to perform this task during deployment. Every year we must re-qualify for the air-to-ground mission and Zaragoza and the Bardenas range allow us to do this successfully, keeping the entire squadron current and ready for the next mission."

The two-week deployment to Zaragoza is a vital tasking of 9 Squadron pilots. Thanks to the support of ground staff, dedication and a strict training regime, the whole squadron will qualify in the air to ground attack role before 'Dedalo-25'. Although slowly ageing, the AV-8B+ continues to be a worthy asset for the Spanish Armada and plays a key role within the aircraft Flotilla. Official details about the aircraft's future in the Navy are expected to be announced this year. **afm**



On exiting the firing range, AV-8B+ 'COBRA 55' cuts through the desert landscape of the Bardenas Reales



9th Squadron Pilot 'DRAC' checks on his ordnance for the mission ahead. Here, two Mark. 76 training bombs are attached to the housing. These will later be dropped at the firing range.

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First E-2D in production for France

NORTHROP GRUMMAN has announced that the first E-2D Advanced Hawkeye for the French Navy has commenced production at its St. Augustine facility.

France has ordered three E-2Ds, with the first scheduled for delivery in 2027. The D variant will replace France's E-2C Hawkeye 2000 fleet, which has

been in service for more than 25 years. The E-2Cs provides air defence and supports the Charles de Gaulle carrier strike group. Janice Zilch, VP of

multi-domain command and control programmes at Northrop Grumman, commented: "Our partnership with France goes back over 25 years. We are proud

to have supported the French Navy with the Hawkeye 2000, and we look forward to providing a generational leap with the E-2D Advanced Hawkeye."

A-29N Super Tucanos ordered by Portugal

PORTUGAL has become the first nation to order the new NATO version of the Embraer A-29N Super Tucano advanced trainer and light attack aircraft. On December 16,

the Ministry of National Defence signed a contract to acquire 12 aircraft as part of a commitment to modernise the Portuguese Air Force. The A-29N Super Tucano variant

incorporates advanced avionics, NATO-specific communications systems and other non-disclosed new capabilities tailored to meet Portugal's operational requirements.



A digital mock-up of a Portuguese Air Force A-29N Super Tucano Embraer Digital

Poland orders three Sky Guardians

A DEAL was signed on December 16 by Poland's Ministry of Defence to buy three General Atomics Aeronautical Systems (GA-ASI) MQ-9B SkyGuardian remotely piloted aircraft (RPA)

systems. The MQ-9B is the newest type of RPA produced by GA-ASI and will serve as the main intelligence, surveillance and reconnaissance (ISR) platform for Poland. The deal also includes two certifiable ground

control stations (CGCS) and three years of GA-ASI's SkyGuardian global support solutions. In 2022, Poland began operating MQ-9A Reapers as part of a lease agreement with GA-ASI. The success

of those missions opened the door for the purchase of the MQ-9B aircraft. The Polish National Defense Ministry said: "In the presence of Deputy Prime Minister Władysław Kosiniak-

Kamysz, a contract was concluded for the supply of MQ-9B SkyGuardian unmanned reconnaissance systems, which will increase the capabilities of the Polish Armed Forces in the field of ISR."

German Tigers bid farewell to 2024

ELEVEN German Tiger anti-tank helicopters took to the air together on December 12 as part of a ceremony to sign off 2024. The German Army Aviation rotorcrafts from

Kampfhubschrauberregiment 36 (Attack Helicopter Regiment 36) at Fritzlar Army Airfield flew over the regiment in order to use last remaining flight hours of the year for the

benefit of aircrew flight currency. The flypast also celebrated the work of the maintenance crews to overcome technical issues with the Tiger helicopters in the past two years.



Auf wiedersehen 2024! A special day for Kampfhubschrauberregiment 36
Sascha Jussen

US Special Ops C-146A Wolfhound for Mildenhall



The USAF C-146A Wolfhound coming in to land at RAF Mildenhall on December 4 Karl O'Kane

A FAIRCHILD Dornier C-146A Wolfhound is now based at RAF Mildenhall, having touched down on December 4, 2024. The Wolfhound (10-3077) landed at the Suffolk air base, pictured, after crossing the Atlantic via Lajes in the Azores, using the callsign 'BANYA 71'.

Commenting on the arrival of the aircraft,

an RAF Mildenhall spokesperson said: "One C-146A Wolfhound arrived to the 352nd SOW from the 524th Special Operations Squadron at Hurlburt Field, Florida. A new unit in the 352nd SOW is not being activated; the aircraft and crew will fall within the 67th Special Operations Squadron. There is no

current estimate of the number of Wolfhounds the Wing will gain, but we'll be postured to welcome more as mission calls to respond to crisis and contingencies within the theatre."

The decision to deploy the Wolfhound within Air Force Special Operations Command's (AFSOCOM) 352nd Special Operations

Wing (SOW) was reportedly taken by US and UK authorities in March 2024 to increase the capabilities of special operations forces within US Air Forces Europe – Air Forces Africa. Basing the aircraft at Mildenhall will reduce response times for a range of missions and, according to the USAF, "provide increased

security, disaster response and emergency airlift capability" for both US European Command and US Africa Command. Before agreeing to station the aircraft in the UK, US officials conducted an extensive environmental impact analysis and shared their results with the British Ministry of Defence."

US F-35 deliveries cut in 2025

DELIVERIES of US F-35s are set to be cut next year and the USAF has been told it cannot retire its oldest F-22s and half of its F-15Es after lawmakers in Washington blocked a request to divest the fighter jets. The 2025 National Defense Authorization Bill (NDAA), which was approved on December 12, reduced the number

of F-35s to be delivered due to concerns in the US Congress about technical difficulties with the Technology Refresh 3 (TR-3) upgrade.

Congress has said that orders for 68 of the stealth fighters would be authorised, but the Pentagon would be blocked from accepting 20 of them until it can demonstrate how it will fix a series of technical problems linked

to the TR-3 programme. These issues led to a delivery halt in July 2023 that has continued for almost 12 months.

The draft NDAA allows the USAF to take delivery of 30 F-35As, the US Marine Corps to have nine F-35Bs and the US Navy and USMC to have a total of nine F-35Cs. In March 2024, the Pentagon had asked for 42 F-35As, 13 F-35Bs and 13 F-35Cs.

It has been reported that the newest F-35s are being delivered with an interim version of TR-3 and can take part in training missions but will not be able to fly in combat until 2025. The Pentagon is understood to be now withholding around \$5m per jet in payments to Lockheed Martin until the new F-35s are combat-ready.

The compromise

legislation also authorises an additional six F-15EX jets on top of the 18 already on order, two C-130J cargo planes, one LC-130 'ski plane' and two C-40s used primarily for VIP transport. These 11 aircraft add \$1.2bn in expense, which lawmakers would fund in part by cutting \$500m in F-35 fighter and KC-46 funding.

Thunderbolts reactivated

MARINE FIGHTER Attack Squadron (VMFA) 251, Marine Aircraft Group (MAG) 14, 2nd Marine Aircraft Wing (MAW), was reactivated at a ceremony on December 5, pictured, at Marine Corps Air Station (MCAS) Cherry Point, North Carolina, following a four-year, seven-month hiatus.

VMFA-251, known as the 'Thunderbolts' or 'T-Bolts', was previously deactivated on April 23, 2020, at MCAS Beaufort, South Carolina, after returning from deployment in 2020 in support of Operation Inherent Resolve. The Thunderbolts' deactivation concluded 34 years as an F/A-18 Hornet squadron. The squadron was then relocated to MCAS Cherry Point to begin its transition to the F-35.

VMFA-251 received its first F-35C Lightning II Joint Strike Fighter delivery on Sept. 17, 2024, marking a key milestone



US Marines with Marine Fighter Attack Squadron (VMFA) 251 march in formation during the reactivation ceremony for VMFA-251 at Air Station Cherry Point, North Carolina on December 5 USMC/Lance Cpl Orlanys Diaz Figueroa

in the squadron's transition process.

VMFA-251 is the Marine Corps' first East Coast-based operational F-35C Lightning II Joint Strike Fighter squadron.

Lt Col Evan Shockley, commanding officer of

VMFA-251, noted: "Today, almost 83 years to the day after it was founded, VMFA-251 reactivated as an F-35C Lightning II squadron. The T-Bolts are humbled and honoured for the privilege of carrying that proud legacy forward.

Our immediate focus is working towards initial operational capability, which means that VMFA-251 has enough operational F-35C Lightning II aircraft, trained pilots, maintainers and support equipment to

self-sustain its mission-essential tasks. Following that, we will turn our attention towards reaching full operational capability to ensure that, when called upon, the T-Bolts will stand ready to serve our great nation."

Getting low

A USAF MC-130J Commando II assigned to the 352nd Special Operations Wing performs low-flying training manoeuvres during Exercise Adamant Serpent 25 in Sweden, on November 19. The mission was part of a European Command-approved exercise conducted annually by US Special Operations Command Europe to demonstrate the ability of NATO allies to deploy and operate within the European theatre while demonstrating military interoperability. **USAF/A1C Cody JA Mott**



American fighters trump all!



A majestic Grumman F-14A Tomcat bearing the markings of the Islamic Republic of Iran Air Force (IRIAF), took centre stage at Kish show. The reflection of the F-14 in the water mirrors the aircraft's imposing form in incredible detail All images Cem Dogut

THE OPPORTUNITY to see Iranian military aircraft was too good an opportunity to miss for Cem Dogut, who attended Kish air show last month

Established in 2002, the biennial Iran International Airshow and Aerospace Exhibition was held for the 12th time on December 10-13. Kish Island, in the Persian Gulf, was the venue for an event that has become prominent in the Middle East's aviation calendar. Getting there was straight forward, and there were no issues with security.

Key participants ranged from local manufacturers like Iran Aircraft Manufacturing Industrial Company (HESA), Iran Helicopter Support & Renewal Company (IHSRC) and Qods Aviation Industries

Company. Along with these companies, airlines and aviation companies located in Iran participated. The largest foreign participant in this year's event was Rosoboronexport from Russia.

The military displays featured Iranian designed and built aircraft, such as the Saeqeh and Kowsar fighter jets, Simorgh cargo plane, Mohajer-6B and Ababil-5 UAVs to showcase the nation's engineering capabilities.

The Islamic Republic of Iran Air Force (IRIAF) sent F-4Es, Saeqeh and Kowsars, but the star of the show for many was the F-14A Tomcat, which is now on the edge of retirement with the new Sukhoi Su-35s expected to replace the legendary fighter next year.

Right: Phantoms affiliated with Oghab 44 have their own unique eagle nose art. In February 2023, the Iranian military revealed its first underground airbase, 'Oghab 44' (Eagle 44), built to house fighters and advanced drones. The number 44 refers to 44th anniversary of the 1979 revolution in Iran



Two IRIAF Phantoms flying in formation. Just below the Iranian flag on the tail is a No 9 indicating the aircraft belong to TAB (Tactical Air Base) 9 located at Bandar Abbas. The aircraft belonging to Oghab 44 are actually TAB 9 aircraft





Iran Aircraft Manufacturing Industrial Company (HESA) has modified several F-5Es, into the unique looking Saeqeh (Thunderbolt) with two vertical tails instead of one. These two aircraft belong to TAB 2 in Tabriz



Three IRIAF T-90 trainers. The T-90 is an Iranian modernization of the Swiss-made PC-7 and is used as a basic trainer aircraft by the IRIAF



The HESA Simorgh is an Iranian light transport aircraft unveiled on May 19, 2022. The aircraft is a modified version of the Iranian IrAn-140 turboprop airliner (itself based on An-140) and has rectangular wings to give it more lift. The horizontal stabilisers have gone from being V-shaped to completely horizontal, but the most notable difference is the new cargo ramp



Two Mohajer 6B UAVs leave white smoke trails, while performing a synchronized manoeuvre. Developed by Qods Aviation Industries Company, Mohajer 6B can perform intelligence-observation-reconnaissance (IOC) and attack missions with up to four miniature munitions. Mohajer-6, which has a 12-hour endurance, a maximum take-off weight of 650kg, can carry a payload of 285lb and a maximum speed of 200km/h, made its first flight in 2017

Argentina resumes Dardo glide bomb project

THE ARGENTINE Air Force has resumed the development work of the FAS 850 Dardo glider bomb, which had been halted for a decade. The first step was to carry out flutter trials with an empty

inert bomb hung on to one of the underwing pylons of Pampa III prototype registered EX-03. The first flight also saw a camera on board to evaluate the performance, followed by a flight to drop an inert bomb

to assess the separation of the aircraft.

The goal is to continue these tests in 2025 and launch bombs, propelled bombs and their guidance systems, then finally bombs with an explosive

charge. The Dardo bomb, today in its Dardo III variant, derives from development that began in the 1990s, which was a conventional bomb equipped with a rocket engine to give it greater

penetration, of which only a few prototypes were made.

A Dardo 2 was developed, but the programme was stopped in 2012.

Santiago Rivas

Guyanese Dornier HAL-228s enter service



Two Dornier HAL-228-201 aircraft, which were purchased from India earlier this year, were officially put into service by the Guyana Defence Force

(GDF) on November 17 at London Air Station, Timehri. The Guyana Defence Force signed a \$23.27m financing agreement with EXIM Bank for the aircraft as

part of efforts to bolster the country's defensive capabilities.

Santiago Rivas (Image: Office of the Prime Minister)

Chilean Air Force transfers CASA 212s to the Army

AT THE start of December, the Chilean Army Aviation Brigade (BAVE) received the only three CASA C-212s in the inventory of the Chilean Air Force, FACH.

Four of these transport aircraft were originally incorporated by the FACH in 1994, comprising two C212-200s in March of that year, which received the serials FACH 960 and 961, and two examples of the -300DF series in July, serialised FACH 965

and 966, but the latter crashed in the Pacific on September 2, 2011.

The three C-212s arrived at the De La Independencia airfield, located in the city of Rancagua, where the main base of the BAVE is located. They will be operated by the Aircraft Battalion of the military unit, which already operates two C-212-300s out of a batch of three acquired in 1997.

Santiago Rivas

Antarctic ops start for Argentine Air Force Saab 340s



On December 5, a Saab 340 of the VI Transport Squadron of the Argentine Air Force (FAA) flew its first operational mission in Antarctica, transferring a group of scientists from the

Argentine Antarctic Institute to the Presidente Frei Antarctic Air Base in South Shetland. Captain Matías Almeida commanded the mission.

The operation began on

December 3, when a group of scientists traveled from the I Air Brigade of El Palomar to the X Air Brigade of Río Gallegos aboard a Fokker F28 aircraft of the Argentine Air Force. On the

morning of December 4, they continued the flight in the Saab 340, which made a previous stop in Ushuaia before arriving at the Chilean Presidente Frei base.

Santiago Rivas (Image FAA)

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Shown in the main pavilion was this model of the two-seater J-20S, which not only revealed its official designation but may also be a hint of a PLAAF interest. It could be used as an airborne command and control post capable of working unmanned aerial vehicles/unmanned combat air vehicles All photos via Chinese internet

No limits?

Andreas Rupprecht continues his round-up of the impressive aerospace show in China – undoubtedly the best event when you consider all the new combat equipment – since the first show was held in 1996

In the last issue we looked at the Chinese fighters on display and how quickly the PLA forces are advancing the technologies. Those advances become even clearer when one compares Russia's most modern combat aircraft, the Sukhoi Su-57, with the Chengdu J-20, China's current high-end fighter.

J-20 outpacing Su-57 and maybe F-35 soon?

The J-20 flew a good year after the Su-57 and even though both are conceptually very different, they represent the absolute spearhead of fighter aircraft capabilities for both industries and air forces. Now, after testing and introduction at the end of 2016, there are likely to have been 300 J-20s manufactured, and more than 280 operational in around ten frontline units. The J-20 is built at an annual production rate of about 100 aircraft and the improved J-20A is fitted with the definitive WS-15 engine currently being tested in at least five prototypes. Compare that with just two dozen or thereabouts of Russian Su-57s delivered.



A model representing the future Su-57E stood in the static display and is shown here during the visit of the Chinese delegation including the Central Military Committee's vice-chairman

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All of this is surprising, because while the J-20 was admired in 2016 at its first brief presentation just as the J-35A was seen this year, its appearance has now become normalised. This is certainly reinforced by the fact that their appearance in the aerial display was also rather tame, but China is more reserved in this regard.

At least four aircraft were shown in flight and perhaps the biggest surprise regarding the J-20 was the public presentation of a model of the two-seater J-20S together with a new improved long-range air-to-air missile, which is still undergoing testing. It is allegedly planned as an airborne command and control post with enhanced situation awareness via sensor fusion and is believed to be capable of controlling a formation of unmanned aerial vehicles or unmanned air combat vehicles like the GJ-11 UCAV and WZ-7 UAV that have been shown over several years.

More Chinese types

In addition to the many surprises we witnessed, this year's show offered many other interesting types.

A total of four Xian Y-20A transporters and YY-20A air-to-air tankers were present, impressively demonstrating the PLAAF's growing strategic transport capacities; the PLAN Naval Aviation, making its first visit at Zhuhai, showed the KQ-200 anti-surface warfare variant, and although less spectacular, the Z-20J utility/transport naval helicopter was making its debut, confirming that it is in use.

The two aerial PLAAF demonstration teams – the 'Ba Yi' with Chengdu J-10CYs and 'Red Falcon' JL-8s – put on their displays, as did the dual-seat JL-10 as a modern jet trainer, helping to underline how Chinese aerospace now produces everything in-house, from simple trainers to high-end stealth fighters.

We also witnessed a huge H-6K bomber with hypersonic KD-21 ALBMs (air launched ballistic missiles) just as we did in 2022, while AVIC/CAC showed a J-10CE built specifically for export, with a variety of new weapons and an interesting option, to carry two medium-range air-to-air missiles (AAMs) on the fuselage. This J-10CE was supposedly the first J-10 not to be manufactured by CAC in Chengdu, allegedly being assembled by the Guizhou Aerospace Industries Corporation instead... leaving CAC to concentrate on the production of J-20s and the sixth-generation fighter.

Unmanned systems

Every observer of unmanned systems knows that in recent years China has established itself as a real powerhouse in the world of drones. Not only has it had the number and diversity of drones in service with the PLAAF for years, but China is now far from 'simply copying' established concepts and designs. The range extends from large strategic drones for air surveillance and ISR, to combat drones of every size and performance, to countless smaller ones with loitering munitions that are revolutionising air warfare in the current Ukraine war, to new concepts for passenger and air freight transport in the civilian sector.

Perhaps the biggest surprise – in the truest sense of the word – was a mothership UAV called 'Jetank' or 'Jiutian', meaning 'High Sky' (or 'Ninth Sky'). The massive UAV stood alone, because of its dimensions. With a 16-ton maximum take-off weight and a wingspan of 25m (82ft), it is said to carry a payload of up to six tons of a variety of air-to-air and air-to-ground weaponry. While presented by AVIC, since it was designed by AVIC First Aircraft Design Institute it is allegedly built by the Shaanxi Unmanned Equipment Technology Company. In terms of configuration it is

roughly comparable in appearance to an unmanned, single-engined A-10A 'Warthog', with a tricycle landing gear arrangement, high-mounted main wing with minimal if any sweep and small winglets. It features an H-shaped tail and is powered by a single WS-9 as used by the JH-7A without reheat on top of its central fuselage. Sensor-wise, it relies on a radar and a prominent sensor dome featuring various electro-optical and infrared cameras. However, its most unique feature appears to be a quickly replaceable modular payload section designed to launch swarms of smaller uncrewed aerial vehicles and/or loitering munitions or even interchangeable from surveillance to strike roles. This is even demonstrated by that module's slightly abstract name, 'Isomerism Hive Module'. Maybe the translation to English is not entirely successful, but the term 'hive' is a clear hint towards its intended role of being able to carry and launch numerous smaller drones... like bees in a hive. Unfortunately, not much more about its current status was available.

Other smaller UCAVs on show of interest were the latest members of AVIC's Chengdu Aircraft Industry Group (CAIG) Wing Loong (WL) family, which included the operational WL-10 aka WZ-10 for surveillance, looking like a smaller Global Hawk, and there was the Wing Loong X – most likely an evolution of the Wing Loong 3 – push-propeller-driven armed UAV/UCAV with an alleged weight of about six tonnes, similar to the US MQ-9 Reaper. The Wing Loong-X MALE-UAV was being shown with a plethora of payloads that included sonar buoy pods, torpedoes, air-to-air missiles and anti-ship missiles thus demonstrating anti-submarine warfare capabilities for the first time. The UAV has apparently begun test flights and was designed to provide maritime security in



Another first was not only the PLAN Naval Aviation's first participation at any Zhuhai Airshow, but the unveiling of the Z-20J as the utility/transport version



large areas, with comprehensive search and attack on submarines, long-range patrols and anti-submarine operations. Slightly smaller, the Wing Loong-6 was shown as a multirole MALE drone developed to meet less demanding requirements combined with high cost-efficiency and an ease of maintenance.

Also on show was a number of UAV/UCAVs marketed under the label of CASC Rainbow (named Cǎihóng, abbreviated as CH) – developed by the China Academy of Aerospace Aerodynamics. Besides the familiar smaller types like the CH-4 and CH-5,

a mock-up of the CH-7 was shown and a promotional video showed for the first time the actual prototype during taxi-tests. The CH-7 is a large flying wing design with a very long wingspan and is aimed as a sensor-craft type UAV acting as a flying ISR or relay-station. Largely overseen and not yet fully understood was yet another member of the CH family, standing a little off to the side and anonymous without a name, but it was wearing low-visibility PLAAF markings. It was rumoured to be designated GJ-X. Externally similar to many other drones, like the CH-5,

CJ-2 or Reaper, GJ-X is equipped with a SATCOM, a Synthetic Aperture Radar (SAR) antenna and an electro-optical turret. It is powered by a domestic turboprop engine with a five-blade propeller and closely resembles the CASC CH-9 MALE/HALE UCAV.

The trend in drone development, especially in China, is to use these systems in a networked manner, co-ordinated as a swarm or in conjunction with other manned systems. This is part of the requirement for a sixth-generation fighter for example. As such it was no surprise that the Feihong FH-97A loyal-wingman was again shown. Under development by the Aerospace Times Feihong Technology Corporation, the Feihong 97 was first unveiled to the public in 2021 at Zhuhai. Since then its design appears to have evolved dramatically both in size and capabilities, even if its current status is unknown. But it was shown as a full-size mock-up, in a carrier-capable configuration, too.

It remains to be seen how these and other types evolve within the next years and even more how the West and especially the US will react to this trend as China pushes on with its many drone initiatives. Large numbers of UAVs operating together in swarm or in a net-centric manner do not only present significant challenges for defenders but also opens up options, not yet known in aerial warfare.

Arms and weapons

For several years, Zhuhai Airshow has been increasing the visibility of its weapons and this year we saw the public unveiling of the HQ-19 surface-to-air missile system that has been in service since 2018/19, often referred to as comparable to the US's Terminal High Altitude Air Defense (THAAD) system.



The latest member of the growing family of AVIC's Chengdu Aircraft Industry Group Wing Loong UAV/UCAVs, the Wing Loong-6 was shown as a new multirole MALE drone



Besides the J-20S and J-35A models, a new long-range AAM was unveiled featuring foldable wings, allegedly six of these new missiles can be carried inside the fighters' weapons bays instead of just four regular PL-15s

A new long-range air-to-air missile, compatible for internal carriage on the J-20 and J-35 fighters was unveiled. Since the J-20 is currently capable to carry only four PL-15 AAMs in its weapon bay, this is quite a breakthrough. Six of these new missiles, expected to be designated the PL-16, with folding tailfins and slimmer main fins for compressed carriage could fit into the internal weapons bay. However, for unknown reasons it was labelled PL-15E, which is the export PL-15 acquired by Pakistan for J-10s. Regardless of its designation, the new AAM is said to offer the same range as the standard PL-15 (about 125 miles: 200km), expected to become the new standard long-range AAM for both stealth fighters in PLAAF service.

A third missile was a new export cruise missile designated CM-98 (also known as Eagle Strike-98) stealthy multi-purpose missile weapon system. The CM-98 missile seems to be a development or a refined variant of the KF-98A standoff submunition dispenser unveiled in 2022 and suspected of being available as an air launched cruise missile (ALCM). It features a stealthy body with a diamond-shape cross section plus two folded high wings and four tail control fins, it is said to be guided by a combined radar/IIR seeker for the terminal phase and INS/Beidou guidance during the initial and mid-stages and carries a 385kg warhead against various targets. Officially, the maximum range of the export CM-98 is limited to 298km, but a PLAAF version can allegedly achieve a maximum range of

around 500-600km, comparable to the US AGM-158 JASSM or French/British Storm Shadow/SCALP.

But what was this?

One interesting side event of the show was this 1:1 model of a futuristic fighter of the 'sixth-generation' in the exhibition area. While created by AVIC as a pure fantasy product known as the 'White Emperor B', it was misread by several Western agencies as a real

concept for China's future sixth-generation fighter jet.

There were sensational reports that "the type would be capable of flying at high-mach numbers in almost near-space altitudes, combining cutting-edge weaponry, artificial intelligence-supported sensors and a human-machine collaboration system in order to enhance pilot decision-making and optimise mission performance".

But it was always just a fantasy.



White Emperor B ... but what if...?

Ben Stanley Hall showcases the rich diversity of aircraft movements up and down the UK

Just Passing

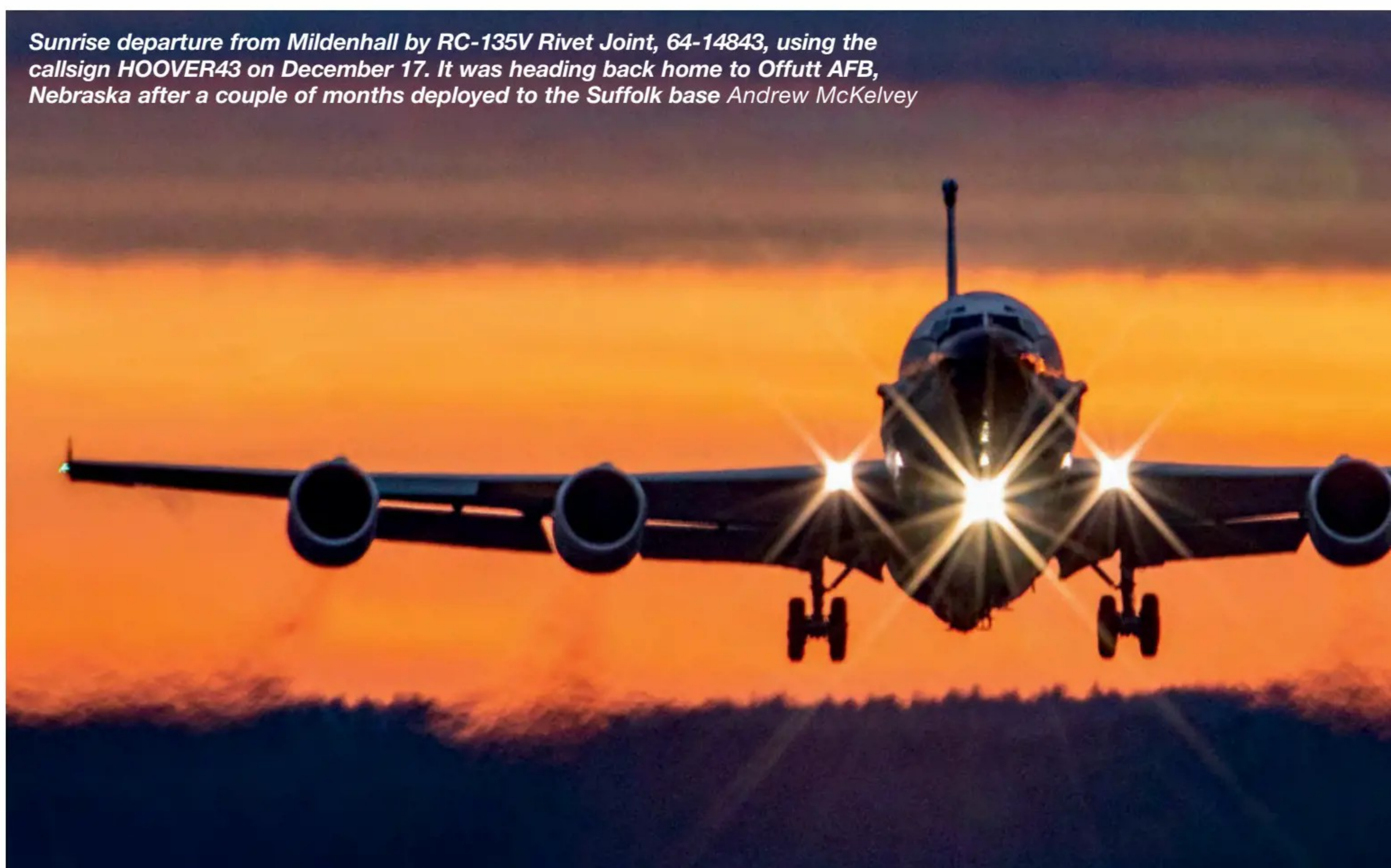


United States Marine Corps C-40A Clipper, 170041, belonging to VMR-1 'Roadrunners' passing through Prestwick on December 9 Alasdair Fraser

This month's selection of movements is dominated by the armed forces of the United States, with transport aircraft from both the USAF and USMC at various air bases and airports across Great Britain. As well as the transport aircraft, we also have a French Air and Space Force helicopter at the nearest mainland UK airport to France and a USAF Intelligence, Surveillance and Reconnaissance (ISR) asset heading back home.

We welcome contributions from readers across the world. If you photograph an aircraft that is not in its usual location or could be of interest, please email your images, without watermarks, to ben.hall@keypublishing.com using the subject heading 'Just Passing Through', with a short caption including as much information as possible. **afm**

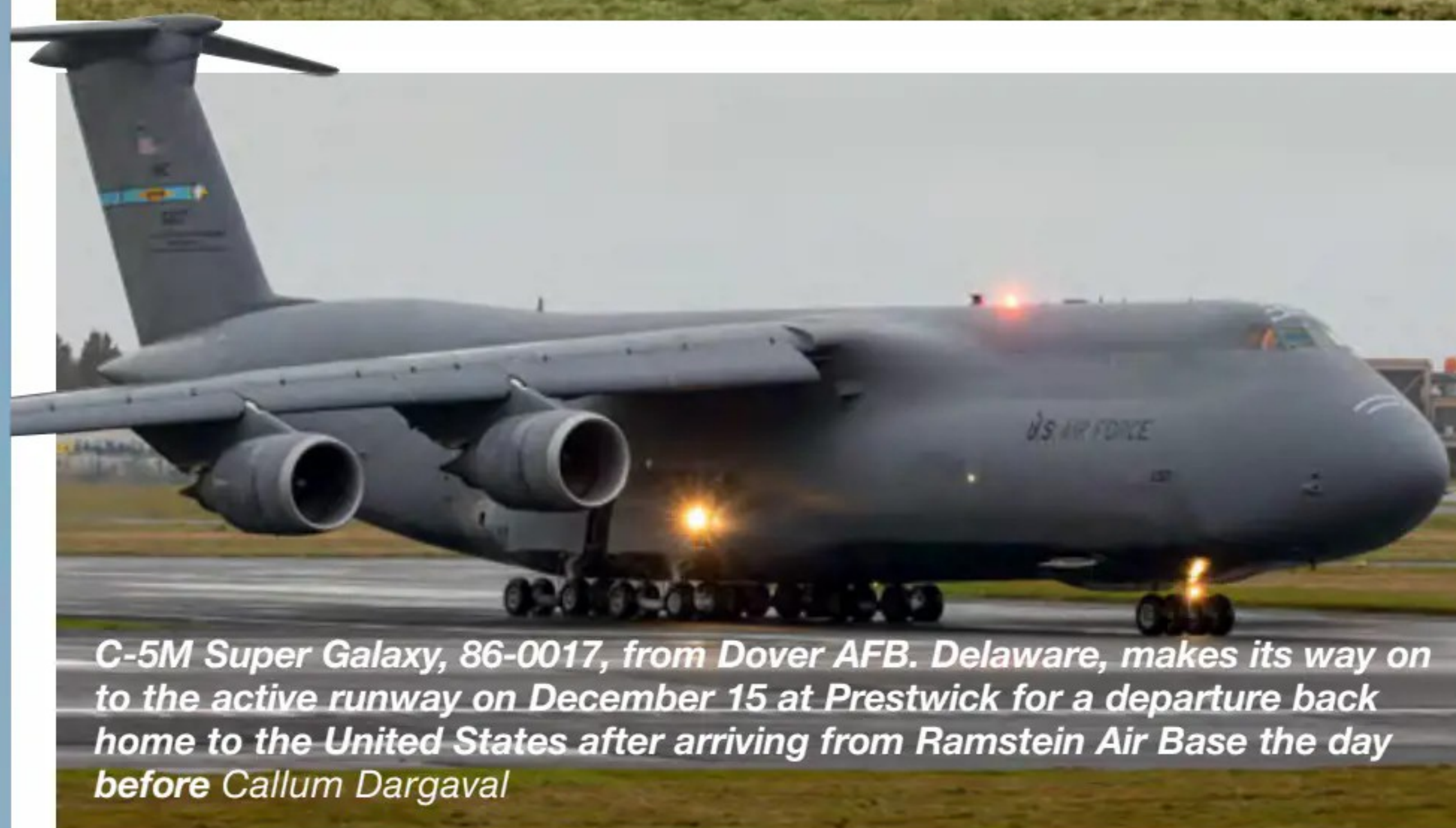
Sunrise departure from Mildenhall by RC-135V Rivet Joint, 64-14843, using the callsign HOOVER43 on December 17. It was heading back home to Offutt AFB, Nebraska after a couple of months deployed to the Suffolk base Andrew McKelvey



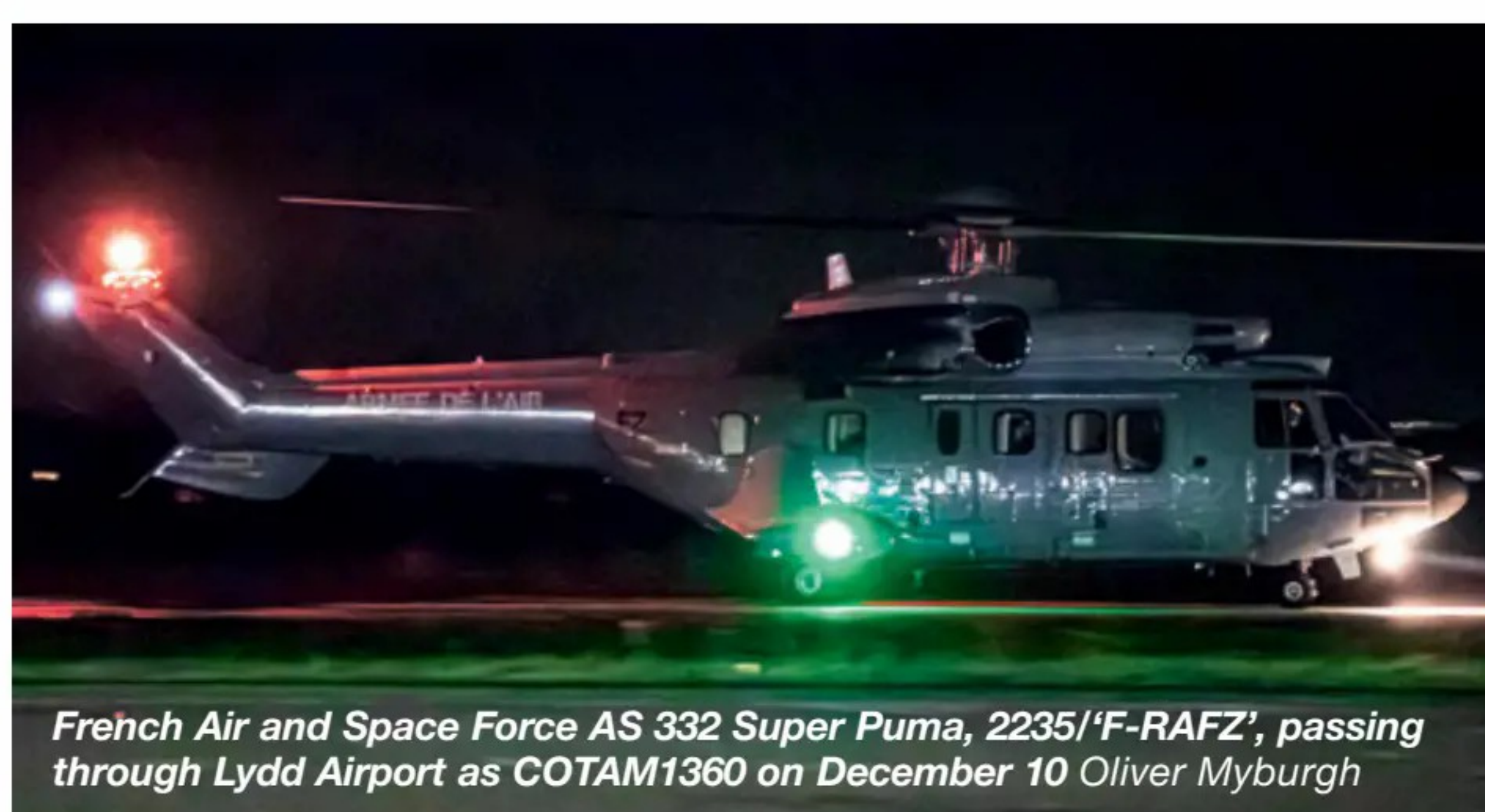
Through



On December 14, this USAF Boeing C-17A Globemaster III, 07-7178, arrived at Cardiff Airport from Stuttgart as RCH696. The aircraft stayed at Cardiff overnight and then departed to its home base of Charleston AFB, South Carolina using the same callsign Jake Didcote



C-5M Super Galaxy, 86-0017, from Dover AFB, Delaware, makes its way on to the active runway on December 15 at Prestwick for a departure back home to the United States after arriving from Ramstein Air Base the day before Callum Dargaval



French Air and Space Force AS 332 Super Puma, 2235/'F-RAFZ', passing through Lydd Airport as COTAM1360 on December 10 Oliver Myburgh



US Marine Corps KC-130J, 169225/'QH', flown by VMGR-234 'Rangers' based at NAS JRB Fort Worth, Texas, lines up for take-off at Glasgow Airport on December 7 Louise Turnbull

Mildenhall matters

It's been a busy year at RAF Mildenhall as **Bob Archer** reveals



RC-135U 64-14847 is shown landing at Mildenhall on October 26 while making one of the type's regular European visits All photos, author unless stated



Royal Australian Air Force KC-30A, A39-004, arrives at Mildenhall on April 6, delivering special forces personnel to exercise with the resident 352nd SOW

RAF Mildenhall has been one of the most exciting air bases for visitor activity in recent times and 2024 was no exception. A wide variety of aircraft transited the base, quite aside from those performing the usual transportation roles. The rarest was undoubtedly the Botswana Lockheed C-130H and the most unusual were a pair of Boeing EA-18G Growlers.

Mildenhall is located in a sleepy backwater of eastern England, but the facility is anything but lethargic. While not supporting the same high volume of traffic as Ramstein, Germany, Mildenhall continues to be an important base for the USAF in Europe and Air Forces Africa, as well as a primary US aerial refueling air station. Airlifters often quick-turn at Mildenhall on their flights to their final destination, with one such a 15th Wing C-17A 05-5152 based at Hickam AFB, Joint Base Pearl Harbor-Hickham, Hawaii, which landed on November 10, and planned to depart to Ramstein after a brief refueling for both aircraft and crew. However, due to a flying control malfunction, which required prolonged repairs, the crew returned home by other means. Once the issues were rectified a replacement crew was

organised, who arrived at Mildenhall and who finally flew the aircraft away on December 3.

The 100th Air Refueling Wing remains the host unit at Mildenhall, which continues to function with a complement of 17 Boeing KC-135R and T models of the Stratotanker. However, the wing usually only has 15 in residence at any one time, as two are regularly away in the US on major overhauls. In previous years, the wing would have received a pooled replacement aircraft prior to sending one of their own for planned depot maintenance (PDM) with the Oklahoma City Air Logistics Center (OC ALC) at Tinker AFB. The system has now changed whereby the 100th ARW has a core number of aircraft, so when an 100th ARW aircraft completes PDM it is returned to Mildenhall ahead of the next one beginning overhaul.

The year 2024 was the 90th anniversary of the RAF station officially being opened. This milestone was commemorated by the unveiling of new station crest, the Tudor Crown, used by King Charles III, replacing the St. Edward's Crown formerly used by Elizabeth II. The new design is being applied to the tails of all 100th ARW KC-135 Stratotankers.

Operations by the 100th ARW were largely unchanged from previous years, with the unit having the primary role of providing aerial refueling training for USA fighter squadrons in Europe, as well as aircraft from other NATO air arms. The 100th also regularly supports the RC-135s that rotate to Mildenhall with the 95th Reconnaissance Squadron. Most RC missions from Mildenhall do not require aerial refueling, but more lengthy sorties, such as those to the Barents Sea or to Ukraine, are always provided with at least one tanker to extend the period on station.

Occasionally, aerial refueling support is provided for fighter aircraft performing patrols of NATO's eastern border with Russia and Belarus. However, the Copper Arrow rotation of reservist KC-135s to Powidz Air Base, Poland, which began in March 2023, when the commitment moved from Spangdahlem AB, Germany, has relieved some of this commitment from the 100th. The unit also assists Air Mobility Command (AMC) or reservist tankers with long distance fighter aircraft deployments. These can be either transatlantic or those staging through the UK while flying to or from the Middle East.



AC-130J 16-5846 landing at Mildenhall on April 2 displays a 30mm cannon and 105mm howitzer protruding from the port side. The array of sensors which acquire targets as well as the defensive antennae are also clearly visible Andrew McKelvey



Collectively, the 100th launches KC-135s every day of the week, often assuming an early morning departure by multi-point refueling system configured aircraft, compatible with hose and drogue receivers.

Whereas for many years the station was closed at certain times during the night and at weekends, Mildenhall now has a 24-hour capability. Likewise, the resident KC-135s frequently perform sorties on days when the station is closed to all but essential movements.

Visiting Tankers

KC-10A

For four decades the McDonnell KC-10A Extender was a regular Mildenhall visitor, but these have gradually been reduced and they are now all retired. The last multiple visit was by a trio of 60th Air Mobility Wing KC-10As – 84-0191, 86-0027 and 86-0031 – supporting the movement of 14 492nd FS F-15Es to the US on February 26 and 28. A small number of single visits followed, until the final KC-10A flight from Mildenhall by 86-0031 departed on August 12 to support four USAF F-16Cs which were returning to the US following overhaul by SABCA at Charleroi, Belgium. More than 40 years of service by the Extender was completed at Mildenhall with the same lack of fanfare as when the first example, 79-0434, visited the base on May 30, 1981. Nicknamed *Big Sexy* due to its alluring sleek wing design and *Gucci* because the KC-10As was cool, excellent and good looking, it bowed out on September 26 in a small ceremony at Travis AFB, California.

KC-46A

The Boeing KC-46A established itself as the new tanker supporting transatlantic deployments, as well as conducting the occasional general airlift. The Pegasus visited in small numbers during the first seven months of 2024, with seven arriving in the space of 90 minutes on August 6, supporting a dozen F-22As on a direct flight from Elmendorf AFB, Alaska to nearby RAF

Lakenheath. Other KC-46s visited Mildenhall to perform local sorties allowing US crews the opportunity to be familiarise themselves with European operations flown within the changeable UK weather.

KC-135

Mildenhall has continued to host KC-135s in transit between their home stations and locations in the Middle East and Africa. The majority of these were single AMC aircraft, whereas those from the reservist squadrons often came as a quartet. These transit KC-135s have been far less in number than previous years, primarily due to a reduction in US assets in the Middle East. However,

Above: 436th Air Mobility Wing Lockheed C-5M Galaxy 86-0021 parked on the cargo ramp at Mildenhall on April 6. Note the colourful DOVER tail stripe, as well as second tail band containing 'Super Galaxy'

Below: The 352nd SOW played host to a number of overseas air arms special forces visits, including the French C-130H 5116 that flew sorties to RAF Sculthorpe in mid-April Andrew McKelvey

the recent expansion in the number of fighter aircraft deployed to the US Central Command region, along with the addition of strategic bombers, has seen a corresponding increase in the tanker fleet to support them. These include a small number of KC-46s, but primarily KC-135s.





Arguably the rarest visitor to Mildenhall for many years, Botswana Defence Force C-130H began its delivery flight at Alverca, Portugal. The aircraft was flown in on May 20 for its official transfer of ownership

During the spring of 2023, a trio of Special Operations Aircraft (SOAR) KC-135s night-stopped at Mildenhall on their flight from McConnell AFB, Kansas, to the US Navy complex at Camp Lemonnier, Djibouti. The aircraft returned to the US some months later. An identical situation took place on April 29-30, 2024, involving SOAR KC-135Rs 58-0011 and 58-0018, which are fitted with Air Refueling Receiver (ARR) systems mounted above the cockpit, as well as conventional SOAR KC-135R 62-3534 and KC-135T 58-0061, all assigned to the



Extremely colourful Rafale C No.146 landing at Mildenhall on June 2 at the completion of its solo display routine at Duxford



Eight US Marine Corps aircraft from the USS Wasp refuelled at Mildenhall on June 9 while flying from the ship to Sweden Andrew McKelvey



22nd ARW. The four are part of the Special Operations Division at McConnell AFB. One returned home in June and another in August, possibly having been replaced in Africa by other SOAR tankers.

Air Combat Command reconnaissance operations

The resident 95th Reconnaissance Squadron has no aircraft of its own but continues to fly a single RC-135V or W Rivet Joint deployed from the 55th Wing at Offutt AFB, Nebraska. The open-ended commitment to maintain an intelligence, surveillance and reconnaissance (ISR) duty in Europe has gained even more importance since Russia invaded Ukraine in 2022. The primary obligation is to regularly monitor frequencies and activities in Russia and Belarus, as well as occupied areas of Ukraine. Sorties are launched at least three times each week as the unpredictability of the Vladimir Putin regime requires the 95th to repeatedly scrutinise communications and determine any changes to the order of battle of Russia and Belarus to ensure both nations do not have any expansion aspirations into NATO territory.

At the beginning of the year, RC-135W 62-4134 was the sole deployed aircraft, which was exchanged for RC-135V 64-14841 on March 9. Additionally, one of the two RC-135U Combat Sent aircraft ordinarily visit the 95th twice each year. They perform their unique tasking of verifying and

Above: Having spent an extended period between Lakenheath and Mildenhall over the summer and autumn, the Boeing delivery/test pilots occasionally performed some impressive routines with the Qatari F-15QAs Andrew McKelvey

Below: One of seven KC-46As that landed at Mildenhall in the space of 90 minutes on August 7 supporting the deployment of a dozen F-22As flying from Elmendorf AFB, Alaska to the Middle East

updating all manner of known emitters, to acquire the location, capability and other vital data on radars and weapon systems previously unknown. In 2024, 64-14847

arrived on August 18 and was scheduled to return home on September 23, but due to the evolving threats the crew was required to instead fly a monitoring mission, then return to Mildenhall. Subsequently, this aircraft has regularly flown the familiar route over Poland to circumnavigate Kaliningrad, as well as observing and updating the military posture and government communications in Belarus. It finally returned home on November 1. This was one of the longest periods of temporary duty at Mildenhall by a Combat Sent for decades.





Special Operations Command activities

The 352nd Special Operations Wing (SOW) began the year with Bell Boeing CV-22Bs Ospreys grounded following the crash of a USAF airframe in Japan in late November 2023. However, by April 15, the circumstances of the loss had progressed sufficiently for a CV-22 to undertake ground taxiing. On June 16, 08-0050 flew two very brief air tests, before making a short flight to RAF Sculthorpe the following day. The MC-130Js were largely unaffected by the Osprey grounding, apart from being unable to aerial refuel CV-22s, and being restricted to performing missions solo.

The 352nd SOW fleet remained constant at nine CV-22Bs and seven MC-130Js. While the Ospreys were restricted to operations within the vicinity of East Anglia, the MC-130Js were able to fly training sorties within the UK and conduct exercises in mainland Europe. The wing was host to a number of Air Force Special Operations Command (AFSOC) aircraft in transit between the US, the Middle East and east Africa. US-based AC-130Js and MC-130Js were periodic visitors, some singly, although on April 2, three 1st SOW AC-130Js night-stopped before departing east. A further two arrived on September 24, but with the serials on the nose and tail taped over. The previous day saw three MC-130Js arrive, looking equally anonymous. All five were eastbound and departed quickly after refueling, except for one of the MC-130Js which was delayed due to a technical issue.

As the year came to a close, there was clearly an increase of AFSOC assets in the

Above: The final KC-10A 86-0031 departed Mildenhall on August 12 to rendezvous with four F-16Cs during their flight back to the US Andrew McKelvey

Below: The elongated refueling probe and host of antennas are clearly visible additions to MH-47G 19-02914, seen taxiing at Mildenhall on September 6

Middle East and East Africa. On November 17, a pair of AC-130Js and three MC-130Js all arrived, following the now familiar trend of having their serials obscured. This anonymity is presumed to be a temporary feature, otherwise the serials would have been completely removed, as is the case with AMC aircraft. However, the purpose is likely to be for operational security reasons.

On the evening of November 20, Feltwell, Lakenheath and Mildenhall were each targeted by a number of small unidentified drones. Subsequently, more evening activity was detected in the vicinity of each base, with various authorities being mobilised, including the East Anglian police helicopter, launched in a vain attempt to track and trace the source. Other military activity involved ground elements from the Royal Air Force Regiment at RAF Honington, other branches of the military security services; various police drone experts, as well as the RAF Beechcraft Shadow R1s of 14 Squadron at Waddington. Additionally, Lakenheath F-15Es were launched to overfly the drones and respond to any aggressive activity taking place.

On December 4, AFSOC Dornier C-146A 10-3077 of the 524th SOS arrived for assignment to the 352nd SOW, with the USAF stating that the deployment had been planned since March 2024. A local mission to Sculthorpe was flown the following day to

enable the crew to familiarise themselves with operations in the UK.

The wing hosted special forces from other air arms, including the French Air Force, which flew local sorties to Sculthorpe from a C-130H between April 14 -26. Hungarian special forces regularly train with the 352nd, arriving and departing aboard their Airbus A319. Australian Air Force Special Forces also visited between April 6-15, arriving aboard Airbus KC-30A A39-004. The most recent special forces exercise hosted by the 352nd was on October 28-31, when personnel from Hungary were joined by troops from Belgium and France. The latter two air arms brought an Airbus A400 each, which flew day and night sorties to Sculthorpe.

Although unconnected with the 352nd, two highly modified US Army Boeing MH-47G Chinooks, serials 19-02914 and 19-02918, belonging to the 160th Special Operations Aviation Regiment (Airborne) were air-freighted from Hunter Army Airfield in Georgia aboard a pair of Boeing C-17As on September 3. After reassembly and air testing, they were escorted to RAF Odiham by an RAF Chinook HC6A on September 9, enjoying the opportunity to fly low level above the Thames along the designated helicopter lane. They subsequently participated in Exercise Dark Lightning in northern England, before returning to Mildenhall on September 28. After





Above: F-16C 87-0350 was one of eight F-16s from the 555th FS at Aviano AB, Italy, that arrived on September 6 for Exercise Cobra Warrior

Right: The port side tail of 87-0350, which was involved in both Operation Bolo and Rolling Thunder in Vietnam.

RAF Mildenhall based aircraft	
As of 08/11/2024	
351st ARS KC-135R/T	
Key * = Multi-point Refueling System; ** = KC-135T; # = Block 45 Cockpit Upgrade	
Serial	Name
57-2605	Wolff Pack
58-0095 **	Silver Dollar
58-0100 #	100 Proof
58-0125**#	The Reluctant Dragon
59-1464**#	Sly Fox
59-1470**	Skipper III
59-1475 #	The Savage
59-1511*	Squawkin Hawk
60-0324	Miss Irish
60-0333*	High Life
60-0335 **	NKAWTG Biggasbird at Tinker for rework
60-0353	Rosie's Riveters at Tinker for rework
60-0355*	Black Jack
61-0315 #	Our Gal Sal
62-3540 #	Holy Terror
63-8878 #	Boss Lady
63-8008*	All American Girl
352 SOW 7 SOS CV-22B	
Serial	Name
08-0048	
08-0049	
08-0050	
09-0042	Executioner
10-0053	Perdiem Queen
11-0057	Sir Poppington
11-0058	
11-0061	
16-0076	
352 SOW 67 SOS MC-130J	
Serial	Name
09-6207	Boreas
12-5759	War Pig - In USA for checks
13-5776	Independence
13-5778	Night Watcher
16-5839	No name - In USA for repainting
20-5937	No name
20-5941	Judgementer

being dismantled, they returned home in the same manner as they arrived.

US Navy and Marine Corps

In recent years, US Navy visitors have been extremely thin on the ground, although there was a brief refueling stop by Boeing P-8A Poseidon 170015 of VP-30 on October 10 with a partially over-painted tail code 'LL'. The Poseidon was fitted with a Raytheon APS-154 advanced airborne sensor mounted in a slim elongated pod along the underside. This sensor can detect, classify and track targets on land and sea simultaneously. The P-8 was on a flight from NAS Sigonella to Keflavik. P-8 visitors are relatively infrequent, as those on temporary duty at NAS Sigonella, Sicily, and NS Keflavik, Iceland, rarely need to stop in the UK while in transit between the two facilities. Furthermore, two US Navy P-8s are also located at RAF Lossiemouth to conduct their core tasking of maritime patrol whenever nuclear submarines sail in or out of Holy Loch in the river Clyde. Invariably, Russian vessels are in international waters off the Scottish coast. Remaining with the larger Navy types, the Lockheed EP-3E Aires II version of the Orion has been an occasional visitor for decades. However, the type is in the twilight of its career, as the ISR role is being taken over by the Northrop Grumman MQ-4C Triton unmanned aerial vehicle. Nevertheless VQ-1 'World Watchers' EP-3E 161410 has been involved in monitoring the ongoing conflict between Israel and groups located in Gaza and southern Lebanon. Sorties were staged from Souda Bay, Crete, until October 30, when the EP-3E flew to Mildenhall before attempting to depart next day to the USA, ahead of returning to NAS Whidbey Island, Washington state. Fog delayed the departure, which was followed by a technical issue, with 161410 finally leaving for NAS Patuxent River, Maryland, on November 1. The second EP-3E at Souda Bay, 159893 was due to follow via Mildenhall but instead routed through NAS Rota, Spain, on November 2, arriving at Whidbey Island on November 6. These were the final operational sorties by the aircraft before being retired and VQ-1 is due to be disbanded on March 31, 2025. In place of the EP-3Es, the US Navy has already begun using the MQ-4C, with169660 flying above the eastern Mediterranean early on November 2 (the Triton is assigned to Unmanned Patrol Squadron 19 operating from NAS Sigonella). A shortage of fuel resulted in two



Grumman EA-18G Growlers and four Boeing FA-18 Hornets diverting to Mildenhall on October 17. The contingent was from the CVN 75/USS Harry S Truman, which was sailing in the North Sea ahead of participating in exercise Neptune Strike 24-2. The six aircraft from Carrier Air Wing-1 (CVW-1) tail code 'AB' were airborne from the aircraft carrier when the vessel sailed too far for their safe recovery. The jets comprised VFA-11 F/A-18F 166640/'104', 166669/'106'; VFA-143 F/A-18E 168922/'202', 166905/'205', and VAQ-144 EA-18G 166931/'500' and 168934/'503'. After approximately four hours at Mildenhall, the aircraft returned to the ship. This was the first occasion that an operational Growler had landed at a military base in the UK. Of these, 166931 was decorated with colourful markings for the commander of CVW-1. One month later, on November 17, MH-60S 167821/'612' also coded 'AB' of HSC-11 made a 90-minute stopover. Earlier, on June 9, a similar diversion involved eight US Marine Corps aircraft briefly visiting Mildenhall for fuel while they were embarked on LHD 1/USS Wasp. They departed the aircraft carrier after training with



A small number of P-8As visited Mildenhall in 2024, with 170015 of VP-30 on October 10 with the APS-154 advanced airborne sensor mounted beneath the fuselage Andrew McKelvey

AC-130J 19-5926 departs Mildenhall on October 6, displaying its firepower protruding from the port side Andrew McKelvey



French special forces. The aircraft were on their way to Ronneby Airport, Sweden, for Baltic Operations (BALTOPS) 24. The first to arrive were four McDonnell Douglas AV-8B Harrier IIs of VMA-365 (Rein) wearing tail code 'YM' serials 164554/'51', 165425/'52', 165580/'54' and 166288/'56', which remained for 90 minutes. As they were departing, four MV-22Bs of VMM-365 also tail coded 'YM' arrived, serialised 168337/04, 168645/06, 168325/10, and 168225/11. The Ospreys stayed for about two-and-a-half hours before continuing to their final destination.

Other Navy visitors included the occasional

C-130 transport, although with no naval air facility in residence, there is a much reduced resupply requirement in the UK. Additionally, US Marine Corps KC-130Js visited Mildenhall to clear customs when positioning from their home stations to Teversham Airport, Cambridge, for major overhaul by Marshall Aerospace.

Visitors

Arguably the rarest aircraft to visit Mildenhall during the year was Botswana Defence Force Lockheed C-130H serial OM4, which arrived from Alverca, Portugal, on May 20, following

a lengthy period of storage. Formerly USAF serial 74-1675, the aircraft was supplied to the Afghan Air Force in September 2013, but was repossessed by the USA when the Taliban assumed power in the country in 2021. OGMA at Alverca stored the Hercules prior to refurbishing it under the USAF's Excess Defense Articles programme. The gifted aircraft was on its delivery flight from Portugal to Botswana, with the circuitous route being necessary as the official transfer of ownership from the US to the new customer was required to take place at a US military air base.

On January 4, the 430th Expeditionary





VAQ-144 EA-18G 166931 was one of six jets from CVN 75/USS Harry S Truman which diverted to Mildenhall to refuel on October 17 Andrew McKelvey

Electronic Communications Squadron (ECS) Bombardier E-11A serial 11-9001 departed Riyadh for the US, with a refueling stop at Mildenhall. These military Global Express aircraft are not uncommon, but the routing from Saudi Arabia to the UK, as presented on ADSB, was extremely interesting, as the flight was shown to have tracked over Simferopol in Ukraine before resuming a conventional course to Mildenhall. It would have been impossible for a sophisticated USAF command and control asset to traverse Russian territory during the present conflict, so why the tracking showed this route is a mystery.

Although Exercise Cobra Warrior 24-1 in the spring was cancelled, Mildenhall hosted fighter aircraft for CW 24-2. It played host again to USAF fighter aircraft with eight 31st FW F-16Cs of the 555th FS from Aviano AB, Italy, arriving on September 6. The exercise did not begin until September 16,

with the preceding week allowing crews to familiarise themselves with northern Europe's congested airspace. The three-week exercise was divided into two weeks of daytime flying and a third devoted to evening/night operations.

The tail art on F-16C 87-0350 was particularly interesting, being a black and pale yellow design with red stars. On the port side was the legend 'Operation Bolo', while 'Rolling Thunder' was inscribed on the starboard. The seven red stars on the tail signified the number of North Vietnamese Mikoyan MiG-21s shot down by McDonnell F-4C Phantoms on January 2, 1967, during Operation Bolo (named after an agricultural machete that doubles as a Filipino weapon).

A small deployment of four F-16Cs of the 119th FS, 177th FW New Jersey ANG flew from Atlantic City to Aviano for Operation

Pegasus Dawn on October 18-25. The operation was designed as an agile combat employment (ACE) training mission to assist the 108th Wing's transition from the KC-135 to the KC-46A. At the completion of the operation, the F-16s flew to Mildenhall, where they remained overnight before flying home the next day. Despite the 108th Wing converting to the KC-46, the flight home was supported by a pair of 305th AMW KC-46s; although it is possible they were crewed by New Jersey ANG personnel.

Overseas visitors at Mildenhall are considerably less common than they were a decade or two ago. A French Air Force Casa



F-16C 87-0230 of the 119th FS New Jersey ANG is shown landing at Mildenhall on October 25 Andrew McKelvey



Despite being more than 80 years old, A-26C N26BP performed a very impressive departure after a short stay on June 26 Andrew McKelvey



CN235M delivered ground crew on May 29, to support a pair of Dassault Rafales. One of the pair, 146, was the 2024 Rafale Solo display aircraft and was resplendent in a very colourful red, white and blue design. The aircraft was temporarily at Mildenhall for Duxford's May airshow. The technicians were collected on June 3 by a Luftwaffe C-130J-30, making the maiden appearance by a German Hercules at Mildenhall. The Australian KC-30A mentioned earlier was not the only Antipodean visitor this year, as a C-17A arrived on July 14, possibly to deliver cargo for the USAF.

Two Qatari F-15QAs were delivered from the US to Lakenheath on July 10, followed by two more to Mildenhall on July 13. These four then bounced between Lakenheath and Mildenhall to enable them to participate at the Farnborough and Fairford airshows, before continuing their journey to Qatar some weeks later. A straggler from the October delivery

remained at Lakenheath and was still there at the end of the year.

AMC movements

AMC traffic changed little compared to previous years. Boeing C-17s were the most common airlifter to visit Mildenhall, along with the occasional Lockheed C-5M Galaxy, although the latter numbered less than 30 throughout the year. Of these, 87-0030 on July 24 brought Army Air Corps AH-64Es ZM738, ZM739 and ZM740 as airfreight, followed on October 7 by 84-0061 containing ZM741, ZM742 and ZM743. In both instances, the dismantled Apache helicopters were towed to a hangar, where they were inspected and loaded onto trailers for the road journey to RAF Wattisham.

A small number of AMC aircraft were devoid of all markings and serial numbers. This policy was introduced by the previous AMC commander for operational security reasons

and has been a gradual process that appears to be continuing, although there has not been any announcement since the new commander took office in September 2024.

Return of reciprocating engines

Civilian traffic at Mildenhall is usually confined to larger Airbus and Boeing airliners ferrying personnel and cargo from the US. However, on June 28, Douglas A-26C Invader N26BP/41-39359 *Million Airess* owned by Marine Aviation Museum Inc arrived while flying in for various UK airshows, including Fairford and Duxford. The highly polished, natural metal Invader had earlier flown over Normandy during the 80th anniversary of D-Day in early June. After a very sporty departure, the A-26 returned to Duxford before flying to Wick Airport in Scotland and Reykjavik in Iceland on the lengthy journey back to Houston, Texas. **afm**

The final visit by an EP-3E to Mildenhall was on October 30 when 161410 arrived from Souda Bay, Crete and departed next day for the US Andrew McKelvey



Ukraine Air War

Three years on

As we approach the three-year anniversary of Russia's invasion of Ukraine in February, the air war between the two has evolved dramatically with new weapons and tactics being employed by both sides. Tim Ripley reports

Three years ago, Russian troops were massing along Ukraine's borders and Western leaders were issuing dire warnings to Moscow. In February 2022, Russian President Vladimir Putin ordered his troops to strike against the Ukrainian capital to deliver a knockout blow against the President Volodymyr Zelenskyy's government.

Under the leadership of their dynamic president, the Ukrainians fought off the Russian attack on Kyiv and drove back Putin's troops in the south and east. Moscow then moved to set up a war economy and the conflict became a battle of attrition.

Air power has played an important role in all phases of the Ukraine war, but as 2024 turned into 2025, air operations were being executed in very different ways to the early days in February and March 2022.

Battlefield air power

Both Ukraine and Russia opened the war in February 2022 with traditional air warfare equipment – fighter jets, strike jets, ground attack aircraft, battlefield helicopters and transport aircraft. They each had a couple of dozen unmanned aerial vehicles, or drones, but only a handful of these were armed.

Russia's opening air operations looked a lot like the US 'shock and awe' offensives against Iraq in 1991 and 2003. Cruise missiles and strike jets, blasted airfields, command posts, air defences and ammunition depots. Russian jets and attack helicopters provided close air support for advancing tank columns. The Ukrainians used their air force to hit back at the Russians and they started to use their drones in unconventional ways to try to slow the advance of enemy columns.

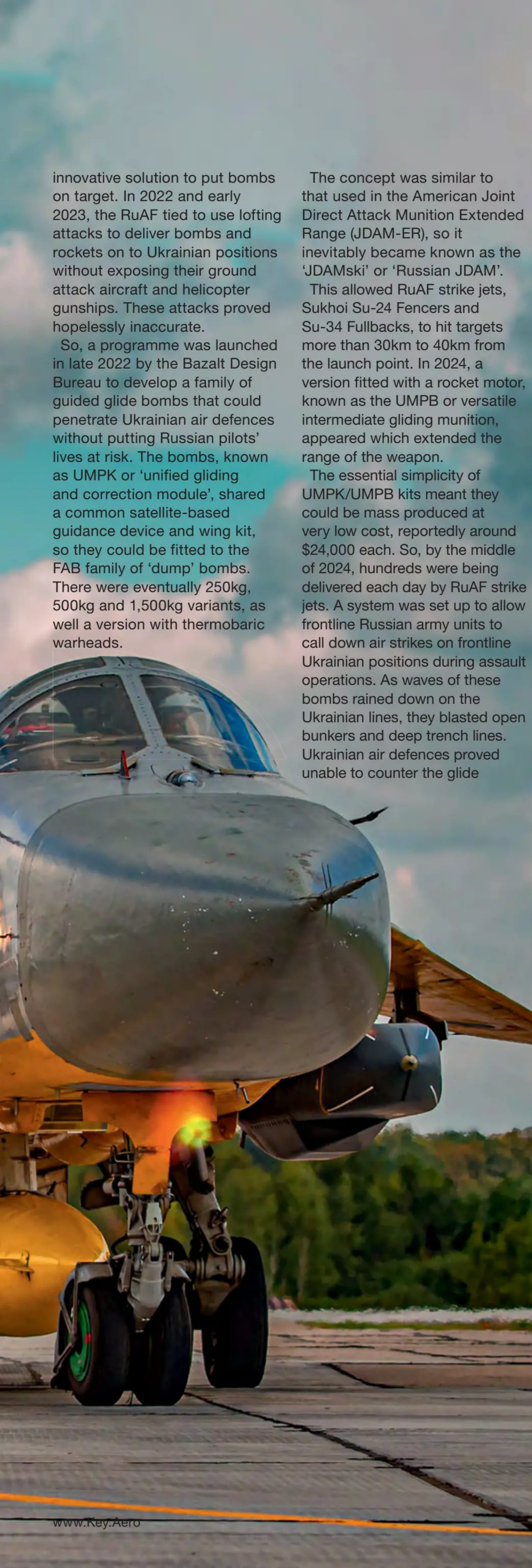
As the 'war of manoeuvre' transitioned into a static battle between dug-in armies, air power had to be used differently with both sides starting to establish thick air defence networks along the 1,000km length of the

battle front. This made the life expectancy of manned aircraft very low. New ways to influence the battlefield had to be found.

In the final months of 2024, the Russian army was on the offensive in key areas of the front. To support its offensive, the Russian Aerospace Force (RuAF/VKS) dramatically recast the way it carries out close air support and battlefield interdiction.

With air defences making it dangerous for manned aircraft to venture close to the front line, Russian air commanders opted for an

British engineers helped design the engineering modifications that allowed Ukrainian Su-24 strike jets to carry British and French-supplied Storm Shadow/Scalp long-range cruise missiles
Ukrainian Air Force



innovative solution to put bombs on target. In 2022 and early 2023, the RuAF tried to use lofting attacks to deliver bombs and rockets on to Ukrainian positions without exposing their ground attack aircraft and helicopter gunships. These attacks proved hopelessly inaccurate.

So, a programme was launched in late 2022 by the Bazalt Design Bureau to develop a family of guided glide bombs that could penetrate Ukrainian air defences without putting Russian pilots' lives at risk. The bombs, known as UMPK or 'unified gliding and correction module', shared a common satellite-based guidance device and wing kit, so they could be fitted to the FAB family of 'dump' bombs. There were eventually 250kg, 500kg and 1,500kg variants, as well as a version with thermobaric warheads.

The concept was similar to that used in the American Joint Direct Attack Munition Extended Range (JDAM-ER), so it inevitably became known as the 'JDAMski' or 'Russian JDAM'.

This allowed RuAF strike jets, Sukhoi Su-24 Fencers and Su-34 Fullbacks, to hit targets more than 30km to 40km from the launch point. In 2024, a version fitted with a rocket motor, known as the UMPB or versatile intermediate gliding munition, appeared which extended the range of the weapon.

The essential simplicity of UMPK/UMPB kits meant they could be mass produced at very low cost, reportedly around \$24,000 each. So, by the middle of 2024, hundreds were being delivered each day by RuAF strike jets. A system was set up to allow frontline Russian army units to call down air strikes on frontline Ukrainian positions during assault operations. As waves of these bombs rained down on the Ukrainian lines, they blasted open bunkers and deep trench lines. Ukrainian air defences proved unable to counter the glide

bombs, which added to the feeling of helplessness among Kyiv's troops.

The real success of the Russian approach to close air support and battlefield interdiction missions was their ability to do it at scale. Hundreds of bombs were delivered each day to frontline airfields, allowing a high tempo of operations to be conducted.

Missile and drone war

Both the Russians and Ukrainians have found new ways to carry out strategic strikes against their opponent's capital cities, industrial sites, electrical infra-structure, air bases and ammunition storage sites. Hitting these strategic 'centres of gravity' have long been identified by air power exponents as the key to victory. The first aim is to destroy physically targets to degrade the enemy's military potential and also to undermine the will to fight among civilian populations. For the Russians, a key objective is to close down Ukraine's power distribution network, so civilians have to live without electricity during freezing winter conditions. In response, the Ukrainians have launched their own drones and missiles strikes into Russia to bring home to the civilian population that they are at risk from Putin's war. This is a return to World War Two concepts of strategic bombing as a psychological weapon, aimed at the enemy's will to fight.

Just as with battlefield air support, strategic strike operations in the Ukraine war are now carried out by new and innovation weapons systems. The Russian military started the war with a huge advantage in this key domain, but as the Ukrainians received advanced air defence systems from the US and other NATO nations, the RuAF's Long Range Aviation (LRA) branch had to drastically re-organise how it operated.

The opening strikes of the war were carried out by sea-launched 3M54-1 Kalibr (NATO: SS-N-27 Sizzler) cruise missiles of the Russian Black Sea Fleet, supported by Kh-101 (AS-23 Kodiak) air-launched cruise missiles carried by Long Range Aviation Tupolev Tu-95 (Bear) and Tu-160 (Blackjack) heavy bombers. Russian land forces missile brigades joined in these

deep strikes with Iskander 9K720 (SS-26 Stone) tactical ballistic missiles. By the autumn of 2022, stocks of these weapons were running low and the Ukrainian air defences were knocking down an increasing number of them.

Today, the Russians have completely revamped strategic strike weapons to better penetrate Ukrainian air defences. It is rare for strikes just to involve one type of weapon. Packages of a variety of weapons are fired to increase the chances of missiles and drones getting through. Kh-101 cruise missiles have been fitted with decoys and flares to defeat radar-detection and heat-seeking missiles. Training rounds of the missiles are also fired in salvos alongside weapons with live warheads to decoy away air defence missiles from Russian missiles with actual warheads. A handful of Kh-47M2 Kinzhal (AS-24 Killjoy) hypersonic missiles are now regularly fired from Mikoyan MiG-31 (Foxhound) fighters to add to the complexity of challenge facing the Ukrainians. Ground launched 3M22 Zircon (SS-N-33) hypersonic missiles have also been used in action over Kyiv on several occasions since February 2024.

To give their strike packages mass, the Russians now routinely fire an equal number of missiles and armed HESA Shahed 136 drones. These are intended to swamp Ukrainian defences, even if few of the drones actually get through to their targets. The Russians have opened their own factories to mass produce the Iranian designed drones, including installing Russian-sourced GLONASS satellite navigation systems and secure communication links. These Russian-built variants are dubbed Geran-2, or Geranium-2, by the RuAF. Ukrainian intelligence estimates the Russians are making 900 Geran-series drones a month, so they have plenty to throw into the strategic air campaign against Ukraine.

In response, the Ukrainians have had to completely revamp their air defence network around Western supplied systems, rather than old Soviet-era surface-to-air missiles (SAMs). They have created a layered network, with US, German and Dutch-supplied MIM-104 Patriot SAMs and French/Italian SAMP-T systems dealing with high level threats.

Lower-level engagements are undertaken largely by Norwegian-designed NASAMS and German IRIS-T SAMs, supported by gun systems.

As Ukraine is a huge country with a land mass as big as Germany and Poland combined, so it has proved difficult for Kyiv to build an air defence network that covers all its territory. To try to fill in gaps between SAM batteries, the Ukrainians routinely launched manned fighters to try to intercept Russian drones and cruise missiles, with mixed success.

One of the most innovative elements of the Ukrainians' air defence network is their early warning system, which is believed to incorporate real-time feeds from US missile launch detection satellites, signals intelligence against Russian air traffic control radio frequencies, social media monitoring and sound detection systems. Early warning is key to giving the Ukrainians time to orientate their air defences against in-bound Russian weapons.

The Ukrainians have also sought to strike back at Russian air bases and industrial/military infrastructure with their own drones and missiles. Their drones are particularly innovative, including converting light aircraft into remote controlled 'flying bombs'. These have struck the Kremlin in the heart of Moscow and the main LRA base at Engels in the Saratov region, more than 700km from Ukrainian controlled territory.

*The delivery of Storm Shadow air-launched cruise missiles to the Ukrainian Air Force was announced in May 2023 and the first missions were flown a few days later.-
Ukrainian Air Force via @Osinttechnical*



*The Su-27, still used by Ukrainian Air Force for air-to-air missions, including hunting Russian drones and cruise missiles
Ukrainian Air Force*

To add to its long-range strike capability, the Ukrainians have integrated British and French supplied MBDA Storm Shadow/Scalp air-launched cruise missiles on to their Su-24 jets. President Zelenskyy has sought for several months to get US President Joe Biden to allow Ukraine to use US-supplied ATACMS tactical ballistic missiles on Russian territory. On November 17, Biden gave the go-ahead for these attacks and the first attacks took place days later. Shortly after, Britain gave permission for its Storm Shadows to be used against Russian territory.

Ukrainian attacks on Russian air bases prompted the RuAF and LRA to mount an effort to beef up their air defences and to disperse their aircraft further away from Ukrainian controlled territory. LRA bombers now routinely operate from bases on the Kola Peninsula, near Murmansk, more than 2,000km from Kyiv when tasked to strike at targets in Ukraine.

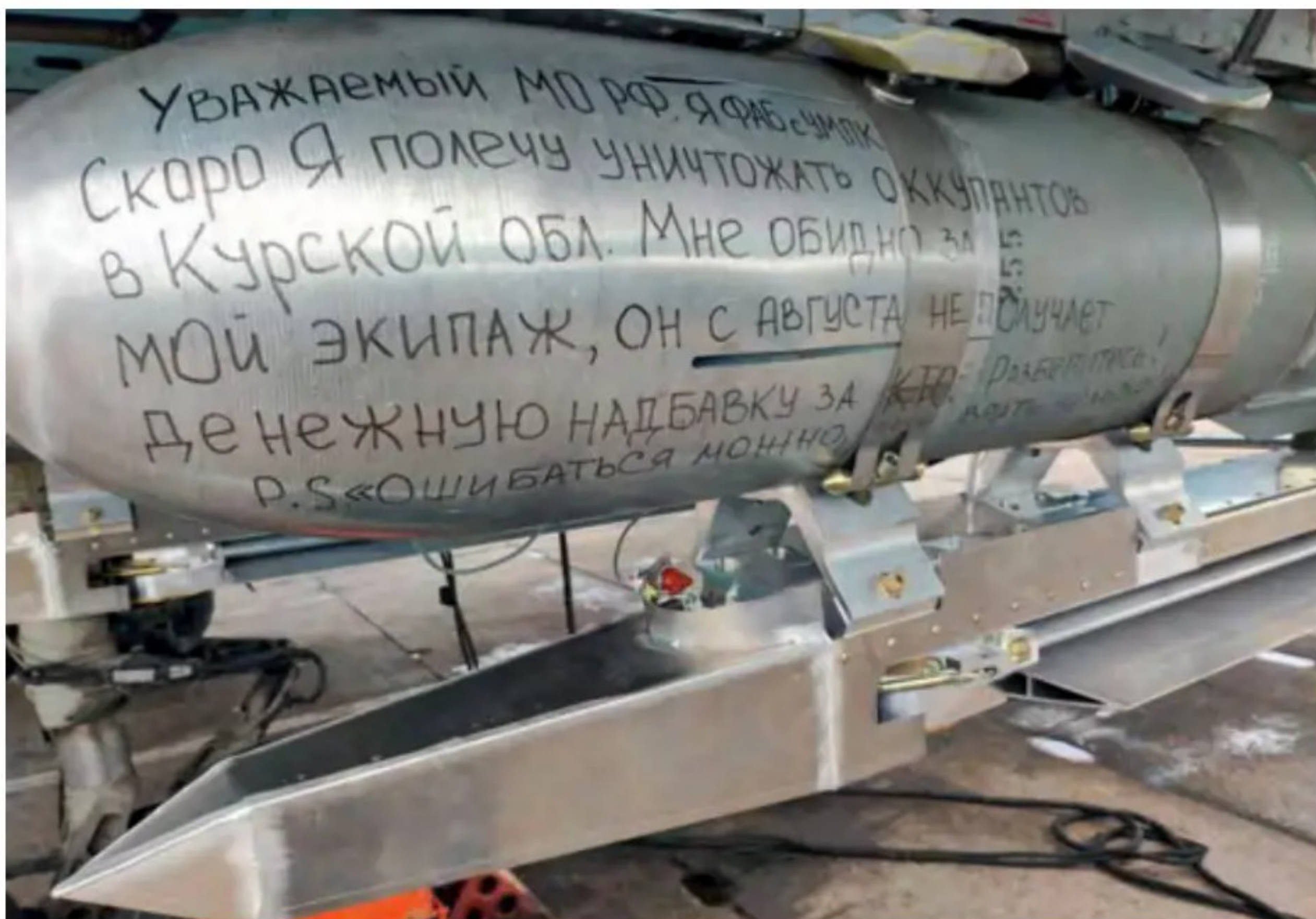
New tech

The Ukraine war has seen a dramatic acceleration in the development of air warfare technology. New drones, missiles and intelligence gathering have all been put to the test.

Three years into the conflict, the development and deployment cycles of these weapons is now at such a pace that some



*A small number of Su-25 ground attack jets are still operational with the Ukrainian Air Force
Ukrainian Air Force*



The artwork on this Russian bomb says: "Dear Ministry of Defence, I'm FAB with UMPK. Soon I will fly to destroy occupiers in Kursk Obl. I'm upset for my crew, they have not received bonus pay for counter-terrorist operation since August. Sort it out! P.S. You can make mistakes, but you can't lie." @wartranslated



Ukrainian air defence kill claims for a massive Russian raid on November 17, 2024. This included the shooting down of:
 1 out of 1, 3M22 Zircon hypersonic cruise missile
 7 out of 8, Kh-47M Kinzhal ballistic missiles
 85 out of 101, Kalibr/Kh-101 cruise missiles
 0 out of 1, Iskander-M ballistic missile
 4 out of 4, Kh-22/Kh-31P cruise/anti-radar missiles
 5 out of 5, Kh-59/69 cruise missiles
 42 out of 90, Shahed drones and other types
 Ukrainian Air Force

Western observers are amazed at the ability of both sides to render their opponents' weapons obsolete in a matter of weeks. This is particularly important in the area of electronic warfare, where jamming technology can render very expensive weapons ineffective. The Russians have put great effort into neutralising the main Western satellite navigation system, the GPS. This is used in the guidance system of several weapons, including Storm Shadow missiles, Excalibur guided artillery rounds and the JDAM family of guided bombs. There are numerous reports from Ukraine that the Russians have significantly limited the effectiveness of these weapons by neutralising their GPS guidance.

Jamming is also regularly used by both sides to neutralise drones by jamming the radio signals used to control them or download video imagery. This is a critical weakness that can neutralise their ability to operate over enemy territory. As a result, both the Russians and Ukrainians have started fitting their tanks and other vehicles with their own jammers.

In a bid to counteract this jamming, Russian one-way (kamikaze) attack drones have

now appeared, with fibre-optic control systems. This involves the missiles spinning out up to 10km of fibre-optic cables behind them as they head towards their target. This cable makes the drones invulnerable to Ukrainian jamming and potentially threatens to render their whole electronic warfare operation ineffective. The speed at which the Russians appear to be rolling out fibre-optic controlled drones is threatening to expose Ukrainian ground forces to unprecedented attacks.

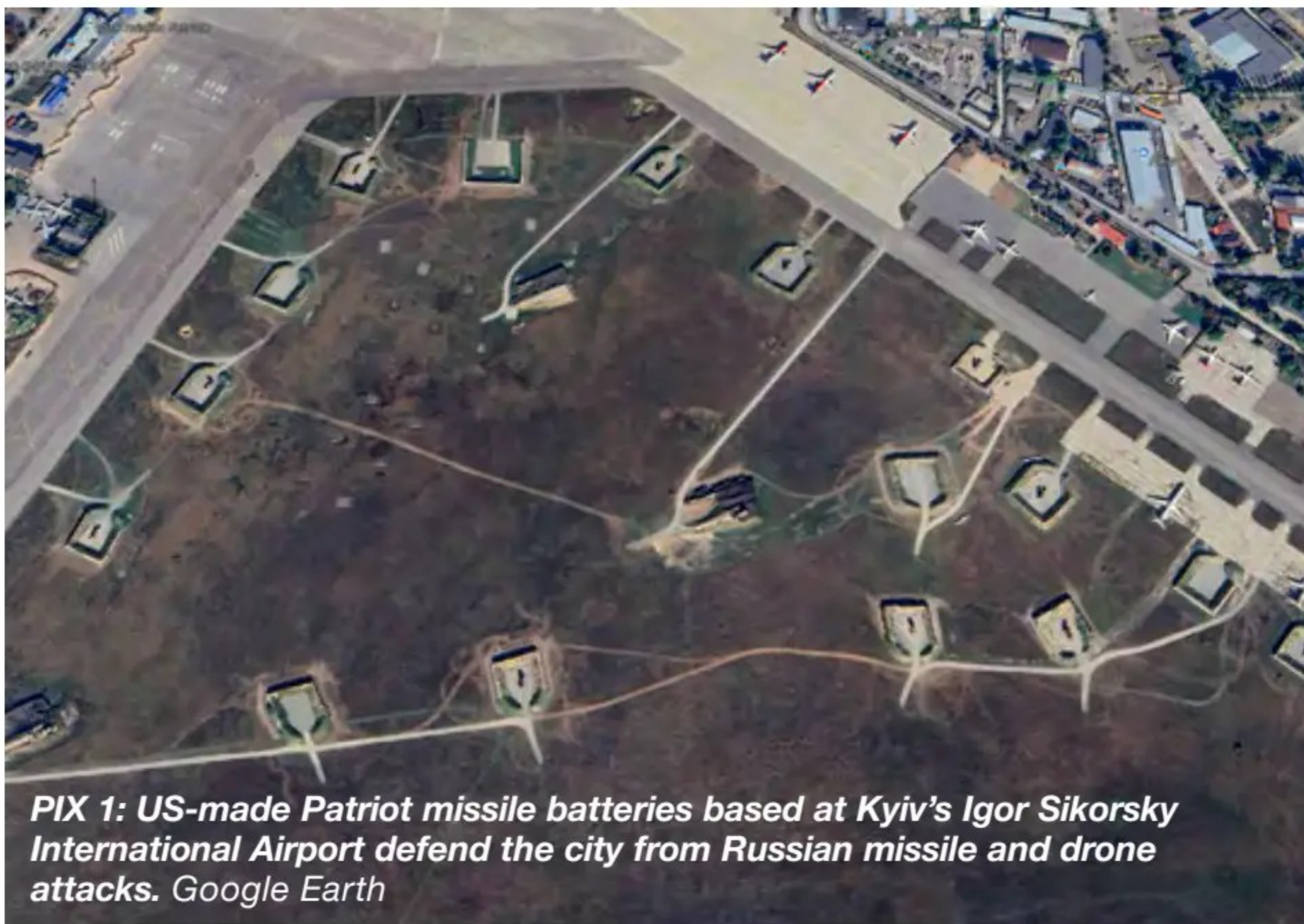
The Trump effect?

High-level diplomacy has been moving fast since the election of Donald Trump as US President on November 5. Trump and many of his key advisors are sceptical of the ability of the Ukrainians to win against the Russians.

This has led to speculation that Trump will force the Ukrainians to the negotiating table, under threat of cutting off US military aid. How this will impact the air war in Ukraine remains to be seen.

The Russian army, backed by the RuAF tactical aviation using glide bombs, has now gained momentum on the battlefields of the strategic Donbas region. Another group of Russian troops, including a contingent of North Korean soldiers, are trying to push the Ukrainian troops out of the Kursk region of Russia. The more territory each side can hold is seen as vital in any future Trump-inspired peace talks.

At the same time, the strategic missile and drone war between Kyiv and Moscow is showing no sign of letting up. The relentless war of attrition between Russia and Ukraine appears to be nearing a critical inflection point. **afm**





Korean Hawk ready to fly

Mina Adel takes an in-depth look at Korea Aerospace Industries' KF-21 Boramae as the indigenous fifth-generation jet prepares to enter service



*A ROKAF/KAI KF-21 Boramae Prototype '005' showing its full air-to-air load out with six Meteor under the pylon with two external fuel tanks
All images aero_typhoon unless stated*

Last November European giant MBDA inked a sales agreement for the procurement of 100 Meteor long-range air-to-air missiles to be integrated with Korea's indigenous fighter jet, the KF-21 Boramae (Hawk). It came after a request from the South Korean Defense Acquisition Program Administration (DAPA).

This agreement won't just provide the Republic of Korea Air Force (ROKAF) with new missiles but will also send out a signal to any enemy, including North Korea, that it now has a state-of-the-art fighter.

On the aircraft's first test flight in July 2022 by pilot Major Ahn Jun-hyun at the 3rd Flying Training Wing in Sacheon, South Gyeongsang

Province, Korea Aerospace Industries (KAI) issued a statement: "The aviation world has been impressed by the aircraft's design, which is similar to American aircraft but enhanced by home-made technology and armament, so Korea launches its new fighter confidently into the future to increase the efficiency of the Korean Air Force at the tactical and strategic levels in light of multiple challenges in the Pacific."

Cost-effective strategy

The ROKAF has consistently depended upon US technology, evident from its inventory. However, the F-4 Phantom aircraft was retired in June 2024 and the F-5 will soon leave the

ROKAF's strike force with a limited number of fighter squadrons. Young Hak Lee 'Mason', a South Korean defence analyst said: "The ROKAF has retired the F-4 and the F-5 soon and both capabilities needs to be filled quickly. The F-16s and F-15s will also be eventually retired too as the South Korean military is replacing foreign products with homegrown ones, from trivial small weapons to large warships, submarines, and missile radars. This, of course, includes fighter jets, and while we have developed the T-50 and FA-50, they are only light fighters and not multi-role.

"There's a problem – we cannot afford the cost of integrating foreign weapons and the cost of upgrading, [we] cannot upgrade or modify at will."

Since the early 2000s, South Korea has pursued a strategy of localising its military sector, adopting and transitioning from foreign weapons to employing indigenous equivalents, and expanding this plan to export. The KF-21, a product of the KF-X project, is playing a significant role in that strategy.

In 2001 KAI President Kim Dae-Jung announced the development of an indigenous fighter jet that would fly in 2015, however, DAPA did not give approval of the KF-X until 2010.

The US, however, refused to transfer core technologies that were needed in the fuselage. In 2015, DAPA selected Korea Aerospace Industries KAI as the leading company and concluded a contract for EMD (Engineering, Manufacturing, and Development) Program.

In 2023, the revenues of the South Korean defence industry were around \$US14bn, with Korea Aerospace Industries (KAI) contributing nearly \$US3bn.

These statistics show the successes in manufacturing cost-effective weapon systems. However, the integration of American systems is



Above: ROKAF F-35A Freedom Fighters like this example landing at Jungwon Air Base in 2024 will work alongside the F-21

Left: The ROKAF/KAI KF-21 Boramae design was a mystery because it is similar to other low observable fighters but not completely stealth

Below left: A ROKAF/KAI KF-21 Boramae Prototype '005' showing off its manoeuvrability by making a dive



difficult so domestic aircraft, such as the FA-50 and KF-21, will seek alternative indigenous solutions to overcome the restrictions.

Lee explained: "Korea has indigenous land- and sea-based missile capabilities, but they cannot be integrated on US-made fighter jets, such as the F-16 and F-15. This is why Korea's indigenous air-launched missiles industry is important – to propel the development of the KF-21 Block and the Block II version."

Secret behind the design

The first appearance of the new Korean Falcon in 2022 confused many experts due to its similarity to fifth-generation aircraft (low observable/stealth) that had completed its Preliminary Design Review in 2018, but its design wasn't completely stealthy.

However, the major goal was to develop a small tactical fighter that introduced a good balance of combat effectiveness in terms of using an active electronic scanned array (AESA) radar, modern data links, long combat range, ease of logistics services such as repair, spare parts, and a life span compared to the Viper. Being manufactured locally, the cost should be significantly reduced not just at the operational level but during the research, development and manufacturing period to obtain a large number of them quickly.

To better understand the Korean KF-21 project approach, I reached out to Vijander K Thakur, a retired Indian Air Force pilot and now a software architect and military analyst. He told me: "South Korea appears to have followed a pragmatic approach which is paying





Above: A ROKAF F-35A Freedom Knight landing in Jungwon AFB in 2024

Below: A PLAAF J-20 Mighty Dragon during its demonstration at Zhuhai Airshow China in 2024

dividends in terms of meeting performance and development time frame goals. Comparing it with the PLAAF J-20, which has less efficient engines. The twin engine J-20 is large. It is more a fighter-bomber than a fighter. While the KF-21 is the other way around – more of a fighter. The export potential of an affordable stealth fighter is great.”

Thakur explained further: “South Korea opted for a stealthy aerodynamics design that assured a significant reduction in RF observability, rather than all aspect low observability based on materials that it had not yet developed. In order to avoid an uncertain development timeline and cost overruns, it designed the fighter around a proven high-performance engine and obtained all the avionics and airframe technologies (21 in total) it could from the US, as an offset for the purchase of F-35s.”

Additionally, a further advantage to the aircraft’s current design is that it can be developed to a more mature low-observable design without the need to build a new model from scratch, which will improve the chances of owning more advanced fighters of the fifth or sixth generation locally. Thakur commented: “The development approach and design of the KF-21 ensures potential for refinement and growth.”

In addition, Lee pointed out: “Advanced 6th generation fighter jets or more are often unavailable for sale, are highly strictly controlled, or under very unfavourable conditions. That is why Korea is focusing its capital and growing technology as quickly as possible.”

There are six KF-21 prototypes, four single-seat (prototypes 1, 2, 3, 5), and two dual-seat (prototypes 4, 6) to speed up the fifth-generation fighter’s development. So far, they have conducted a supersonic flight, weapons separation test (with Meteor and IRIS-T) while KAI plans included 2,200 sorties to finish the Engineering, Manufacturing, and Development program by 2026, with a projected cost of

\$US6bn, with Indonesia investing a 20% share for 48 jets.

Specifications

The aircraft has measurements close to the F-35 aircraft with a length of 16.9m and a width of 11.2m and flies at a speed of Mach 1.8 with a combat range surpassing 1,400km (900 miles) and a combat payload close to 8 tons.

In July 2024, DAPA selected Hanwha Aerospace to supply the KF-21 project with 40 F414 engines manufactured under a licence from General Electric. The powerplant is currently used in many Western fighters such as the JAS 39E/F Gripen and F/A-18E/Fs. Regarded as extremely reliable, the F414 engines can boast 57.8 kN of military thrust and 97.9 kN with afterburner.

In terms of technologies, the Korean Agency of Defense Development (ADD), a top-notch weapon research agency, selected Hanwha to provide key components such as the Multi-Function Display (MFD) with a 20 x 8in low-reflection touch screen, to support the pilot’s flight mission more effectively.



KF-21 Boramae



Above: A Scale Model of the KF-21 Boramae with Manned-Unmanned Teaming (MUM-T) Drones at (ADAS) 2024 in Pasay RHK111

Below: A KF-21 first aerial refuelling test, with a FA-50 alongside, in March 2024 KAI

Israeli defense contractor Elbit has equipped KF-21 with embedded Terrain Following-Terrain Avoidance (TF/TA) systems through a \$43m contract from Hanwha Systems. Currently Hanwha is working on its new AESA radar that emits multiple frequency beams at the same time to detect enemy targets, although the range and other capabilities are unknown. In terms of passive detection capabilities and laser targeting, KF-21 will have the ability to be equipped by Infra-Red Search and Track IRST and Electro-Optical Targeting Pod (EO TP).

One of the best innovative systems will be the internal Combat Aircraft Training System (E-CATS) from LIG Nex1 and Royal Netherlands Aerospace Centre (NLR), which is similar to the system on F-35, as a cost-effective solution to train new pilots on the

ground either individually or in formations and this can improve their teamwork skills. Embedded electronic warfare (EW) will be provided by LIG Nex1 with a mix of deceptive/noise/complex/multiple jamming techniques besides signal analysis and threat identification algorithms.

Lethal claws

The weapons strategy of the KF-21 is based on two fixed elements – accuracy and long-range, which is understandable due to its restricted carriage. There will be four missiles for long range engagement, while keeping its distance from US munitions. The aircraft has ten external hardpoints; in terms of air to air there's the shorter-range IRIS-T that can be cued up with the pilot's helmet mounted sight (HMS), and the Meteor missile for long-range air combat up to 125 miles (200km).

Starting in 2024, the Koreans began working on domestic missile projects, long-range and short-range air engagement missiles; some structural models have been shown, without any technical details. KAI



Above: KF-21 dual seat prototype 006 on its first flight in June 2023 KAI

also has a project for KGGB guided bombs with a range of 63 miles (100km) and a new version of supersonic cruise missiles designed to attack naval targets like the Air-to-Ship Guided Missile-II, Skydragon long-range cruise missiles with a 500-mile (800km) range, as well as dedicated hypersonic air-launched ballistic missiles of the KTSSM missiles family, used to strike strongly defended targets.

In addition, there is an interceptor missile project known as Ascent Phase Interceptor based on L-SAM-I (Long range Surface to Air Missile) with the ability to intercept ballistic missiles in the boost phase when the missile engines are firing. If this project succeeds it will play a vital role in South Korean Anti Access/Aerial Denial (A2/AD) capability, with the priority being the north.

Finally, there's the next Generation AI-augmented drones or 'loyal wingman' programme that KAI presented at Seoul's ADEX-2023 defence show (and Farnborough 24) under the air-launched effects (ALEs) concept. According to the company, the concept will pair three to four AAPs to one KF-21 to perform many missions such as decoying, jamming, intelligence collection, air combat and attack in a similar way to the US Collaborative Combat Aircraft (CCA) concept, that could also work with light combat aircraft such as the FA-50.

Boosting the ROKAF Fleet

The fighter's armament plan is highly promising, and it raises the question about to what extent the new aircraft can bolster other ROKAF fighters in a similar manner as per NATO doctrine when many types are integrated.





The ROKAF adopts Western-style air doctrine through air supremacy, via unprecedented levels of intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) platforms like the E-7 Wedgetail airborne early warning and control (AEW&C) aircraft, Hawker 800XPs, and Falcon 2000s designed for signal intelligence SIGINT and monitoring on communications (ELINT) with RQ-4 Global Hawk drones along with surveillance satellites. All these technologies, together with intelligence elements on the ground, will provide a comprehensive picture of the predicted threats, to guarantee the ROKAF has enough time to operate against its northern neighbour, by hindering the enemy's offensive capabilities through missile systems. The second reason covers military operations in the Pacific, when long-range strikes would be carried out against targets defended by A2/AD capabilities

With ROKAF plans to field 130 fighters, the KF-21 can adapt through its better technological and armament systems, ensuring combat for a longer period than the rest of the fleet, especially US aircraft, because of the use of local munitions while at the same time not depleting the balance of US and European munitions.

It is expected the ROKAF should receive an initial batch of 20 aircraft out of 40 Block-1s in late 2026; the other 20 will be contracted in 2025 and to be received in August 2027. This could herald a future with more advanced Boramaes, especially if it succeeds in winning a lot of export deals that will fund the fifth-generation jet's research and development. **afm**

Lee explained: "Korea's purchase of the F-35 and the KF-21 development should not be considered as one project. The reason for buying the F-35 is to quickly respond to adversary stealth fighters in a short period of time, and the KFX program is part of the Korean Air Force and Korea's grand plan. The initial KF-21s will have air-to-air

missiles while the Block-II will be configured for air-to-air and air-to-ground missions. The Block-I will be integrated with fighters currently serving the ROKAF."

In addition, Thakur stated: "Weapons wise, it will be like a NATO fighter. Good and expensive weapons that will help with the integration process of any future Western system."

Two KF-21 breaking and releasing flares from the ROKAF F-4 formation during its farewell flight. May 2024 KAI



Watching the waves

Chris Melaisi and **Stewart Marshall** spend time with the courageous 'Tusker' crews who cover Canada's Northern territories, Eastern seaboard and beyond, and are on constant alert across land and water to save Canadians in distress

Situated on the country's East Coast, Nova Scotia is home to Canadian Forces Base (CFB) Greenwood. Here, 14 Wing hosts one of the Royal Canadian Air Forces' boldest squadrons. Operating through day and night, 365 days a year, 413 Transport and Rescue Squadron incorporates a fearless team, dedicated to saving lives through use of two formidable assets: the Lockheed CC-130H Hercules and the Agusta-Westland CH-149 Cormorant.

History

Watching the waves for more than 80 years, 413 Squadron has served a multitude of duties throughout almost continuous service. Operations began in July 1941, when the first Canadian overseas flying boat unit was established at Stranraer, Scotland. In the early days, the newly formed unit flew the PBY Catalina Mk. I from Scotland's southwest coast and latterly the Shetland Isles, tasked with

general reconnaissance, convoy escort and anti-submarine patrols over the north Atlantic. Operations from Scotland ended in February 1942, as the squadron began to prepare for a hurried move to the Far East. It moved to Ceylon (modern day Sri Lanka), which was seen as a key link between East and West and under threat from Japanese naval forces. The squadron remained in Ceylon until early 1945, when it returned to the UK for what turned out to be a short-lived stint as a bomber unit. This was until it was disbanded on February 23, 1945. The squadron had accumulated more than 11,000 flying hours, but was now not required for war efforts.

Post-war, the unit took over the duties of 13 (Photographic) Squadron at Rockcliffe, Ontario. The Royal Canadian Air Force (RCAF) was eager to re-implement its aerial mapping programme. Following the end of the war, particular attention was paid to the Canadian



Cormorant 149907 undertaking a post-maintenance engine run. CC-130H 130333 is being pushed from the hangar, also after maintenance, and now declared 'green' for SAR operations All images by authors



Above: SAR technician A Barr in front of the Cormorant after landing on a remote beach during a training exercise

North and Arctic regions, where accurate mapping was non-existent. Crews were initially assigned a mix of B-25 Mitchell and PB-5A Canso aircraft, along with a single Noorduyn Norseman aircraft before finally receiving some re-purposed Lancasters. This enabled them to take full advantage of the Lancaster's long range, to map most of the Canadian Arctic. Having gained experience working in extreme conditions of the far north, the unit participated in Operation Polco in 1950. Here, they were tasked to locate the north magnetic pole, which was critical information to enable accurate aerial navigation at the time. Following successful completion of the operation, the squadron was again disbanded.

The squadron re-emerged as a frontline force on August 1, 1951 – a fighter squadron out of CFB Bagotville in the Quebec province. Equipped with the F-86 Sabre, it deployed in 1953 to Zweibrücken, Germany, as part of 3 Wing. The squadron was stood down on April 7, 1957 and reformed a month later back at Bagotville, operating the Avro CF-100 Canuck as an all-weather fighter unit as part of the NORAD shield. The squadron was again disbanded on December 30, 1961.

It was then inactive for seven years before reactivation at CFB Summerside, Prince Edward Island on July 8, 1968, classed as a rescue squadron before being formally redesignated in August 1970 to the current function as

413 Transport and Rescue Squadron. In the same year, six CC-115 Buffalo aircraft were transferred from 429 Squadron to provide new search and rescue (SAR) capabilities. Three were sent to Summerside and the others to their west coast counterparts at CFB Comox. The Buffalo replaced the Grumman CSR-110 Albatross, which wasn't as capable when conditions in the Atlantic were poor. The increasing capability of helicopters had begun dominating the 'rescue' part of SAR operations from the mid-1960s, with the introduction of the CH-113 Labrador, mitigating the need for an amphibious fixed-wing aircraft. The original RCAF order of six Labradors for SAR squadrons was later bolstered by 12 ex-Army variants; all were upgraded over five years to form a single standard for SAR work, known as the CH-113A. The upgrade consisted of a new front door hoist, Bendix weather radar, GPS and the highly visible, yellow paint scheme.

The 1989 federal budget cuts to the defence department identified CFB Summerside as a candidate for base closure. In 1991 it was closed and most military personnel transferred to CFB Greenwood. Summerside's last operational unit, 413 Squadron, made the 270-mile journey south in June 1991 to form the current Greenwood squadron.

The CC-115 Buffalo was replaced by the CC-130E/H Hercules shortly after 413 transferred to the new base. The CH-113A soldiered on until 2002, partly due to the original replacement being cancelled after a change of government in 1993. The





Above: 'Tusker 912' pictured above the autumnal forests of New Brunswick while out on a training detail. These remote areas provide ideal scenarios for practising confined landing and hoist operations

Left: SAR technician J Kovacs awaits the go-ahead to jump from the ramp of the CC-130H. Training equipment is strapped on to simulate medical and survival equipment in SAR scenarios

Below: CC-130H 130333 running up at dusk. The squadron crews train weekly during the hours of darkness





The aircraft commander and first officer on board the Cormorant survey the wilderness of New Brunswick, looking for a suitable site to practise a hoist scenario



SAR technician A Barr repels down approximately 200ft from the Cormorant into a remote area

Agusta Westland AW101 was selected as the new rotary SAR platform and given the designation CH-149 Cormorant. The first Labrador replacement was handed over to 413 in August 2002, becoming today's search and rescue fleet.

On June 26, 2024, squadron members travelled back to their SAR proving grounds at Summerside to celebrate the 100th anniversary of the RCAF. Their CC-130H Hercules was joined by the Canso 702 PBY-5A for a static display demonstration for the local community.

Current operations

One of three RCAF 'heavy' search and rescue units, 413 Squadron's counterparts are stationed at CFB Comox and CFB Trenton. The squadron manages both fixed-wing and rotary assets under 'one roof'. This everyday

Role of the SAR technician

Search and rescue technicians are highly trained specialists who provide advanced pre-hospital medical care and rescue for those in distress in remote or hard-to-reach areas. These men and women are trained to a primary-care paramedic national standard with additional advanced skills. SAR technicians are land and sea survival experts who specialise in rescue techniques, including Arctic rescue, parachuting, diving, mountain climbing and helicopter rescue. The SAR tech role is not a direct entry trade – individuals must have served a minimum of four years in the regular forces or in the reserves, prior to applying for voluntary occupational transfer.

The annual in-take will see applications ranked by suitability where only the top 30 are invited to attend selection. This involves aptitude and physical ability tests, followed by a land survival course at Jarvis Lake, Alberta. Approximately half of the initial group will be selected to attend the year-long SAR Tech RTM (restricted team member) course. Their training continues once posted to the squadron, with the goal of achieving a top-level qualification. In phases, RTM SAR Techs progress to an unrestricted team member, to conduct operational missions and, ultimately, the team leader course.

The SAR technicians are backed up by ground-based personnel in the 'SAR shop', within the 413 hangar. The shop is effectively a warehouse-sized space, comprising all equipment that could possibly be needed for SAR – from parachutes to medicine and Arctic survival kits, to chain saws and scuba-diving equipment. Personnel based in the shop maintain equipment currency and ensure there's always safe, fully operational gear ready.

One recent SAR mission resonated with all members of the squadron – the rescue of 31 crew from the *Atlantic Destiny*; a stricken fishing trawler, running adrift at night, in dire sea conditions. The call came in late on the evening of March 2, 2021, from the Halifax Joint Rescue Co-ordination Centre (JRCC). It tasked the squadron to respond to a ship that was taking on water following a fire in the engine room. Noting the large number of people who would have to be recovered from the ship, the squadron detached all unnecessary equipment from the Cormorant and launched alongside the Hercules within 15 minutes of the call.

While en route to the last known location, 130 miles south of Nova Scotia, the US Coast Guard was also preparing its MH-60T and HC-144A Ocean Sentry aerial assets to launch from Air Station Cape Cod.

The Hercules was first on scene to find the ship adrift sideways, with 30ft-high seas and 55 knot winds hammering the vessel. The SAR techs aboard the Hercules dropped a dewatering pump and radio onto the ship, which was the first critical step in enabling the mission. Shortly after the aerial delivery, they gained altitude and began providing illumination with flares to assist the Cormorant pilots during their hoist sequence as they approached.

SAR technician, Warrant Officer Fernando Bianco, was on board the Cormorant 'Rescue 902' when it arrived on scene around 2330hrs. He said: "When we got above the ship, SAR technician Sgt Brad Nisbet was the first to go out on the hoist, the boat was rocking violently in the conditions and he hit the side of the ship hard in the descent. We immediately brought him back up and thankfully he wasn't injured. He managed to get onto the deck on the second attempt and I followed to assist with the extraction of the crew. The seasoned skipper had already created an order of evacuation, so we could quickly start hoisting crew members up to the Cormorant using the rescue basket.

"We managed to get six people on board when the aircraft commander reported an oil pressure warning, a serious issue requiring a speedy return to land, which meant leaving us on the ship with the remaining 25 crew."

The CC-130H, which had been providing top cover and lighting up the sky above the rotary assets, followed the Cormorant to Yarmouth in southern Nova Scotia, where they landed and ferried the Cormorant crew back to Greenwood, as another helicopter was being readied.

Meanwhile, the two US Coast Guard MH-60T Jayhawks arrived to conduct extractions with the assistance of the Canadian SAR techs still aboard the vessel. Bianco continued: "We managed to get eight people onto the first Jayhawk, at which point they reached their maximum weight. The second Jayhawk crew were then simultaneously jettisoning equipment into the sea whilst we conducted the evacuation, with their quick actions resulting in 16 people being lifted onto the third helicopter."

By the early hours of the morning the second Cormorant arrived on scene. However, in the worsening conditions both winch cables were snapped by equipment moving on the ship's deck and the rocking of the boat in the swell. The Cormorant was now unable to airlift the crew, so dropped medical equipment for SAR techs to attend to crew members who had been injured during the night.

As the circumstances became bleak, Bianco prepared for the worst-case scenario: "We were stuck on the boat, which at this point was listing badly and not far from sinking, so we dropped a life raft on either side of the boat to plan for which side was best for evacuation. Luckily, we got a call from the JRCC to advise a Canadian Coast Guard vessel was now only 30 minutes away. They deployed their rapid rescue craft, for which we made a rope system to safely transfer the remaining crew onto the rescue craft." The *Atlantic Destiny* sank within two hours of the evacuation being completed; thankfully all crew members had been evacuated without serious injuries.

Commenting on the success of the mission, Maj Kristin MacDonald, officer in charge at the JRCC in Halifax, said: "We were very fortunate to have had the support of the US Coast Guard during this rescue. Their ability to provide such valuable support in the saving of the lives of these fishermen is very much appreciated and demonstrates how important our relationship is in providing search and rescue services to both Canada and the United States."

In October 2024, the 413 Squadron personnel involved in the rescue were recognised for their courageous and outstanding professionalism. Both SAR technicians were presented with the Star of Courage, along with the aircrew of Rescue 902 receiving the Meritorious Service Cross: Captain J D Appolloni, Captain S W A Finn and Corporal D J Domonkos.

RCAF 413 Transport and Rescue Squadron

interoperability makes it a unique for several reasons: Air forces don't typically operate composite squadrons, mixing two different aircraft types –comparable units would be US Combat Search and Rescue (CSAR). Also, it's a completely integrated unit; it delivers its own

search and rescue technicians to facilitate rescue. Another factor which makes 413's mission unique is the scale and vastness of Canada's geography – the squadron has to be prepared for any scenario within its 1,800,000 square mile area of responsibility (AOR).

The unit's SAR roots are within the parachute rescue role; maximised by the Hercules' strengths in speed, range and persistence to deliver two SAR technicians in parachute rescue. An array of heavy-duty equipment can also be paraded from the ramp to

Future of SAR at Greenwood

The RCAF is undergoing large-scale recapitalisation, where the only aircraft to remain will be the CC-144 Challenger, CC-177 Globemaster and the CC-130J Hercules. This transition will see the SAR squadrons evolve to operate new aircraft with increased capabilities and a centralised training platform.

The air force has recently implemented new technology on board the legacy CC-130H, testament to its confidence in the iconic machine. Cellular airborne sensors for search and rescue (CASSAR) have been integrated to aid in the search for missing individuals. CASSAR equipped aircraft can identify and communicate with a search subject's mobile phone, providing a precise location and enabling text or voice message to confirm condition and validate the level of distress, even in the absence of a cellular network. In practice, 413 Squadron was able to locate a missing vessel using the CASSAR system and communicate with the occupants within minutes of being in range, despite prevailing weather conditions that included thick fog.

Despite the renewed interest in the type, the CC-295 Kingfisher will ultimately replace the Hercules as the next-generation fixed-wing platform; 413 Squadron is currently sending its SAR technicians to CFB Comox ahead of time to train on the new aircraft to keep their impact of being away to zero. The squadron is starting to transition maintenance and air crews to the new aircraft, aiming to be ready to hold primary SAR duty in 2026.

Reminiscing on the Hercules' incredible service and his personal experiences operating the type, 413 Sqn CO, Lt Col Mark Norris said: "Any transition is going to have its challenges. However, we remain positive and optimistic about receiving the Airbus CC-295 Kingfisher and we know it will be a great platform once fully integrated. It will complement the Cormorant well during all matters of tasking.

"It's been a huge privilege to be a C-130 squadron, especially as we are transitioning away from such a historical aircraft. It's a legacy that we feel responsible for, and it will be a sad day when it eventually leaves our squadron. For now, though, they serve their purpose well and will soldier on serving our nation until the torch is passed to the CC-295."

The CH-149 Cormorant has reached 20 years' service and now needs modernisation with next-generation equipment. The Canadian Department of National Defence has awarded Leonardo a CAN\$1bn (£559m) contract for the AW101/CH-149 "Cormorant Mid-Life Upgrade (CMLU) Project for 16 aircraft, comprising 13 existing Cormorant SAR helicopters currently in service and the augmentation of a further three aircraft. This contract will enhance the aircraft's systems and technologies to a standard similar to the Norwegian Air Force AW-101 – arguably the best search and rescue helicopter in the world.

The CMLU is expected to extend the life expectancy of the fleet to 2042+ with the airframes being returned with zero flight hours. Moreover, this project addresses the need for an improved training solution. By contracting CAE to provide a domestic flight simulator configured to modernised aircraft, Canadian aircrews will have dedicated training capacity at CFB Comox and will no longer need to travel to RAF Benson in Oxfordshire to train.

The transition may be daunting for some. However, the renewed capabilities will equip the squadron with new methods of conducting SAR and keep them watching the waves for many years to come.



SAR technician J Kovacs prepares to drop equipment from the CC-130H. Communication, medical and survival equipment can all be delivered via parachute from the ramp



Two SAR technicians work together to co-ordinate aerial deliveries from the back of the CC-130H



Tusker 912 practising a confined landing on to a beach in blustery conditions



The CC-130H operates at low level during training and rescues; pictured here skirting around Nova Scotia's Cape Split



Above: The flight engineer prepares the SAR basket to be lowered to SAR technicians 200ft below



Right: CC-130-30H 130344 is pushed from the hangar to the flight line, indicating it's now ready for operations

those in need, whether that is kits to survive in the wilderness until rescue, or chainsaws to clear a landing zone for rotary colleagues. The 'Cormorant' contributes its own unique strings to the SAR bow through the hoist and the ability to land in confined spaces, which can enable access to the remotest of locations on land and at sea. The two-aircraft approach allows a unique take on SAR, with both aircraft responding to incidents and working together in a layered approach. The CC-130H is

primarily used in the 'search' stage and further supports the Cormorant during 'rescue'. The CC-130H provides an immediate response, being able to reach a scene expeditiously. On task, they conduct the search phase and establish communication with the party in distress, dropping any critical supplies. The Hercules will be an operations and communications platform to direct the rescue via Cormorant or other assets.

The squadron's SAR function is managed by the Joint Rescue Co-ordination Centre (JRCC) in Halifax, which is operated by the RCAF and the Canadian Coast Guard (CCG). The squadron is obligated to have a Hercules and Cormorant on standby for JRCC tasking at any given time. The 413

Squadron Commanding Officer and Hercules pilot Lt Col Mark Norris explained: "The first step in enabling rescue is alerting, this can come in the form of a locator beacon being activated, which uses government satellites to collect information and distribute to SAR co-ordination centres. Other options would be to call 911, shooting a flare in distress or simply calling someone else for help, whether that be physically or using a mobile.

"All these pathways would follow an escalation process until the situation reaches the JRCC. In Halifax, the tactical controller known as an SAR mission co-ordinator reviews the situation and, if deemed necessary, they would task an aircraft to respond. From the squadron's perspective, we receive basic information at this



Aircraft 149915, receiving attention within the squadron hangar. Contractor IMP Aerospace has been the long-term provider of maintenance requirements for the RCAF CH-149 fleet



Cpl A St Laurent inspects equipment in the section dedicated to underwater rescue. All equipment is regularly checked to ensure all is in fully working order

point and begin preparation to launch. Our aim at this stage is controlled urgency, getting a plan together and under way as quickly as possible.”

In decades gone by, the squadron would participate in a variety of transport taskings. However, these have scaled back considerably with the Greenwood unit only receiving a few of these per year. Typically, these missions come in the form of logistics or mobile repair support within their AOR. Their non-standby aircraft can be tasked by the Canadian Joint Operations Command (CJOC) to conduct national defence taskings, which has led to some interesting taskings in recent months.

In September 2024, the squadron was involved in the delivery and retrograde of RCAF CF-18 Hornets, conducting ocean crossings to participate in Exercise Cobra Warrior in the UK. This mission is known as a ‘duck butt’, where the CC-130H provides a specific SAR service over the ocean, meaning they are on hand to assist if an CF-18 runs into issues. The route planning of the Hornet ocean crossing takes into consideration the location of vessels as a ‘diversion’ point if an aircraft must ditch – the cold temperatures of the north Atlantic make it imperative that the crew exit the water quickly. The CC-130H provides an escort role



and is tooled up with equipment tailored to this mission. If air crew end up in the ocean, the Hercules will locate them, establish communication and paradrop life rafts and medical equipment to aid in their rescue. Additionally, after the air crew manage to board a vessel, SAR technicians can parachute down to provide medical assistance.

The squadron also has historic ties to the NASA Space Program and provides standby cover during the Boeing and Space X launches from Cape Canaveral, Florida. Every launch of the crew vessel programmes transit through the squadron's AOR during the critical phase. An agreement is in place where aircraft are on standby to respond to an incident during this small timeframe. RCAF SAR technicians also head down to Florida to conduct physical training on the capsules as there are extremely toxic chemicals within them that require specialist recovery training. This operation is all part of supporting the US Air Force's rescue package up the Eastern seaboard.

As of October 2024, the squadron has rescued 71 people from a total of 150 SAR taskings in 2024. Lt Col Norris said: "One of the fundamentals in our work is that we're an economic enabler. Being based on the Atlantic coast, we have a huge maritime workforce to oversee with oil and

gas platforms offshore and a strong fishing industry within our AOR. Working alongside our sister squadron in Gander, we work to make sure these people can go out and perform their business safely every day."

Continuous development

Every weekday, the squadron conducts a day and night-time training sortie enabling crews to gain hands-on experience. All aspects of SAR are covered with a mix of land and maritime sorties along with 'remain overnight' exercises where crews can venture further into the AOR to train in unfamiliar surroundings and terrains.

Capt Aaron Noble, CH-149 Cormorant pilot, said: "We try to find unique situations that we have never come across before so we're constantly building our abilities, whether that is a difficult hoisting operation or a new confined landing area. We frequently work with the local Coast Guard vessels, where we set up opportunities to conduct hoist training onto the ship deck. This tends to be most dynamic and challenging hoist operation to practise working with the moving target. However, it's a vital skill given the likelihood of facing a real rescue of this nature."

Capt Ethan Williams, CC-130H Hercules pilot, added: "Alongside the Cormorant we

work closely with the Coast Guard and will practise dropping water pumps or life rafts to vessels in daylight or with the aid of flares after dark. We also practise the same actions over land, typically utilising the Goose Bay Weapons Range for flare work, where we can also drop messages or radios at targets. Our aircraft commander will normally co-ordinate with the SAR technicians to understand their training or currency needs and devise a plan for that day or evening."

Every year, the unit sends members for survival training in the Arctic. The unit's AOR extends north to Baffin Island, the most populated part of the Canadian Arctic. It's an extreme environment, so is vital that members have a high level of exposure working in these areas. A recent tasking saw one CH-149 and CC-130H deploy to search for two missing persons in this area, with relief crews being required due to the long transit times to reach the northern tip of the AOR.

Climate change is also making the environment more challenging and dangerous, with sea ice not forming as quickly or lasting as long. This is putting people at risk for longer. It's overall a huge challenge, with its size and diversity and with poor weather, the squadron must be fully self-sufficient due to a lack of suitable aviation alternatives. **afm**



The 'bird bath' in action to remove any traces of sea water from the Hercules. This is utilised after every mission involving low-level flying over water, to prevent corrosion

The Luftwaffe's last two Tornado Wings, TaktLwG 51 and TaktLwG 33, operate in the SEAD and nuclear/precision ground attack roles Gary Stray



Riding the whirlwind

The Tornado was the Luftwaffe's most numerous aircraft from the early 1980s. Today, just two wings remain, and they are due to be phased out by 2030. **Kevin Wright** talks with Tornado aircrew from both units

Germany purchased 357 Tornados in the early 1980s; fewer than 85 remain in service, fulfilling two crucial roles. Tactical Air Wing 51 (TaktLwG 51) 'Immelmann' operates from Jagel-Schleswig Air Base in Schleswig-Holstein. It flies in the Electronic Combat Reconnaissance (ECR) role, a long-standing euphemism for the highly specialised Suppression of Enemy Air Defence (SEAD) task. Büchel Air Base and temporarily its current operating base at Nörvenich – is home to the Luftwaffe's

Tactical Air Wing 33 (TaktLwG 33). It maintains aircraft on nuclear alert, as the Luftwaffe's direct contribution to NATO's nuclear forces.

SAM suppressors

The Luftwaffe ordered 35 ECR Tornados in 1986. Their cannon armament was deleted, and they were fitted with the more powerful RB199 Mk 105 engines. The first was delivered in May 1990, with the final example handed over on January 28, 1992. It was also the

last of 357 Tornados assembled by MBB at Manching for the Bundeswehr.

The aircraft is operated by TaktLwG 51 'Immelmann' at Jagel Air Base, having assumed the ECR role from JBG 32 in 2013. The unit controls all the Luftwaffe's ECR Tornados, plus a small number of the original IDS versions and some dual-control 'GTs' trainers.

Lt 'Daniel' (full name withheld) is a weapons systems operator with TaktLwG 51 who joined the wing in 2022 and described its aircraft and their critical task. The heart of the Tornado



Two ECR Tornados from TaktLwG 51 'Immelmann' return to their home base at Jagel-Schleswig.
Bundeswehr/ Florian Friz

ECR is its Texas Instruments Emitter Location System (ELS). He said: "Our role is to find, fix and attack enemy air defences, suppressing them to protect our attack aircraft as they approach their targets. After major updates, our Tornados are pretty much state-of-the-art for locating enemy air defence systems.

"We try to sequence our activities so that enemy systems remain out of operation for as long as our bombers could potentially be vulnerable to them and requires precise co-ordination with the attack aircraft. We mainly operate between 8,000ft and 24,000ft because of local airspace restrictions in Europe, but our sensors and the HARMs work well at these altitudes. We also practise at low-level, where the Tornado operates at its best and where it is safest for us when in contested airspace. In an actual conflict, we would prefer to fly very low.

"The ECR can carry up to four AGM-88 HARM missiles, but two are more usual, which allows us to carry extra fuel tanks. For self-defence, the aircraft has a wing-mounted

BOZ Chaff/Flare dispenser. A Tornado Self-Protection Jammer (TSPJ) is carried to provide electronic countermeasures."

He continued: "We would not necessarily have to launch our HARMs during wartime missions to be successful. We are also successful if we force the enemy to shut down their radars and air defences through our presence, effectively suppressing them for a few hours while our attack aircraft pass through their threat ring. In the SEAD role, we closely co-ordinate with our attack formation to know their time on target and the direction they will approach so we can maximise our protective cover for them.

"We locate the enemy's SAM systems using our Tornado's ELS. We can then attack them with our AGM-88 HARM missiles, GBU-54s or unguided bombs, either destroying the enemy systems or at least forcing them to shut down to avoid being hit. Our attack aircraft can safely enter the enemy threat ring to hit their designated targets. We can also 'bait' the enemy systems with our aircraft, but that is a very high-risk tactic and not something we usually do."



TaktLwG 51 ECR Tornados carry AGM-88 HARM missiles to destroy enemy radars
Bundeswehr/Stefan Petersen

The Luftwaffe's Last Tornados



Upgrades

Lt Col 'Chris' (full name withheld) is a Tornado navigator and current CO at the Luftwaffe's TaktLwG 33 at Büchel. From 2013 onwards, a series of 'ASSTA' updates modified the aircraft's software and hardware. Col Chris described the upgrade TaktLwG 33 Tornados have undergone: "ASSTA 3.0 brought a Multi-functional Information Distribution System (MIDS)/Link 16 to improve crew situational awareness and interoperability, plus a secure anti-jam UHF radio. Even without full functionality at that stage, Link 16's importance in improving the crew's situational awareness cannot be overestimated. It also brought better displays for the navigator and a new screen

Left: ASSTA 3.1 was a major mid-life update for Luftwaffe Tornados, including new multi-colour displays for the WSOs Bundeswehr/Oliver Pieper

Below and top: In 2024, TaktLwG 51 hosted the NATO Tiger Meet and painted an aircraft to mark the event Bundeswehr/Celina Nestler





for the pilot. Soon after, we got ASSTA 3.1, another significant mid-life update that brought full functionality to the Link 16. We are now up to ASSTA 4.1, with all our jets getting this recent software update, which has brought even more improvements. We feel this gives us capabilities up with the Eurofighter.

“ASSTA 3.0 enabled us to carry the 230kg (500lb) GBU-54, LJDAM (Laser Joint Direct Attack Munition), which has become our main weapon. With a relatively small warhead, it is great for precision interdiction and close air support. We can use it in GPS mode or by lasing the target, selecting the impact angles and different bomb fuse settings. We still have stocks of dumb bombs, but have not trained in using them very much since we obtained the precision GBU-54 capability. It was a huge leap forward for us. Before that, we had the GBU-24, another laser-designated weapon, a 910kg (2,000lbs) bomb, a bunker buster, or a wide area weapon depending on the warhead option chosen.

“We also have the Taurus air-launched cruise missile. It is an important weapon because it gives us considerable standoff capability. Our Tornados carry two 27mm Mauser cannons, each with 180 rounds, mainly used for ground strafing attacks. We carry two IRIS-T missiles for self-defence, a great short-range air-to-air weapon.”

Strike/attack

Col Chris added: “When I came to the squadron, we did mostly medium-level conventional operations, as we used to do in

Kosovo and Afghanistan. In the last two years, there has been a shift in emphasis back to low-level flying. We practised this in our recent large Pacific Skies exercise in Alaska. While we never lost the capability to operate at low level, there is a renewed importance attached to the techniques used.

“We are working hard with the GBU-54, using it as a GPS weapon. We can set the impact angle and use it in a lofted delivery, allowing us to stand off a considerable distance from the target. We are also using the lofted release in conjunction with laser designation. You come in very low, climb, release the bomb and laser mark the target. It is tough to do when you are pulling up from an extremely low level, but we are getting into it.”

TaktLwG 33's Tornados are also Germany's contribution to NATO's nuclear deterrence forces. The Luftwaffe is one of several NATO air forces that commit dual-capable aircraft, like the Tornado, F-16 and increasingly the F-35A, to the Alliance's nuclear forces. Col Chris explained: “The nuclear role is still our top priority. That comes first, we must ensure we are always ready for that, all our other conventional mission capabilities are second to it.”

Replacement

While the Tornado has given excellent service, it is facing imminent replacement. Col Chris said: “The Tornado's airframe was intended to operate with us for around 3,000 hours over 20 years. Some of our jets have flown more than 6,000 hours and some will fly for over 40 years before they are retired. The avionics are great after the MLUs, but the airframe is getting old.

Pacific Skies 24

In June 2024, TaktLwG 33 deployed 12 Tornados to Alaska as part of Exercise Pacific Skies 24, a major international event involving US, French and Spanish aircraft. As Lt Col Chris, CO of TaktLwG 33 'Ghost' Staffel, explained: “Our Tornados' involvement was limited to just the Alaskan phase. Our Eurofighter and tanker elements later continued to Hawaii, Australia, India, Japan and New Zealand. The Joint Pacific Alaska Range Complex covers an area equivalent to a large part of Germany. For us, it was superb to fly at 100ft in reheat and know that we were disturbing no one, as the entire area is almost completely uninhabited.

“This was an all-in scenario for Büchel. Most of the wing's aircrew, from both Staffels, ground crews and

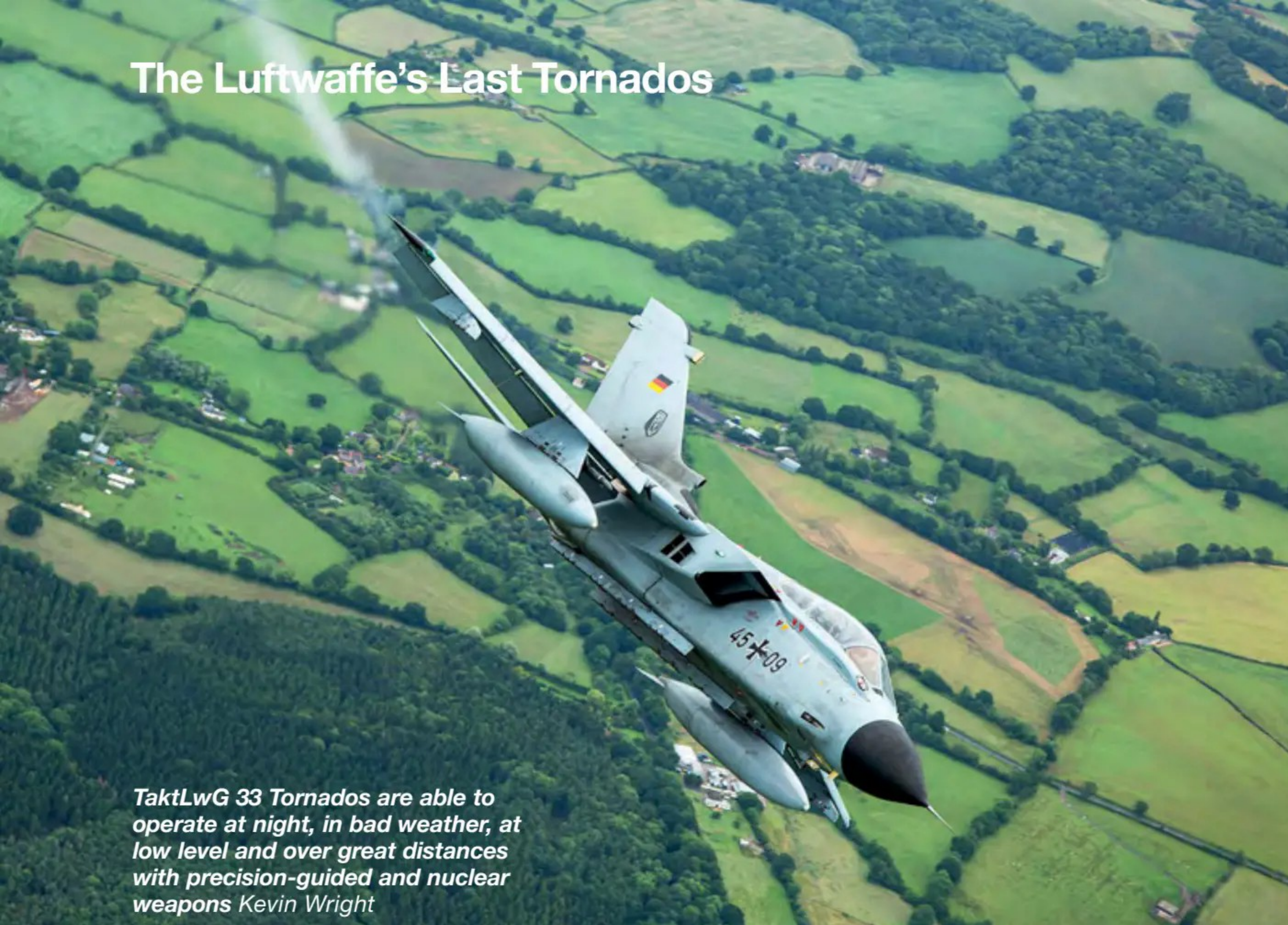
support staff, were involved. It was unusual for us to deploy on a large scale from just one wing. Pacific Skies was a big commitment; we left just a few crews back in Germany. It was great for both squadrons to work together again, especially as we have had to split up our operations while temporarily operating from Nörvenich.

“During the first two weeks, we focused on low-level flying. At home, we can normally fly down to 500ft, but in Alaska, we stepped down to 100ft, which initially took some practise to become accustomed to. We got to drop GBU-24 and GBU-54 weapons on the ranges, too. It was great to do more operationally realistic tactical flying training than we can do back in Germany.”

A TaktLwG 51 Tornado departs Joint Base Elmendorf-Richardson, Alaska, on a training mission during Pacific Skies 24 USAF/SRA Julia Lebens



The Luftwaffe's Last Tornados



TaktLwG 33 Tornados are able to operate at night, in bad weather, at low level and over great distances with precision-guided and nuclear weapons Kevin Wright



Take off from Nellis AFB during a Green Flag West. TaktLwG 33 Tornados can mount precision attacks with targeting pod and GBU-24 Paveway bombs Bundeswehr/Johannes Heyn



Things break, and having been built by three countries, who all used different subcontractors, many of whom are no longer in business, it is getting harder to get some spares items.”

After early expectations that Germany might purchase F/A-18E/Fs and EA-18Gs to meet its Tornado replacement needs, the Luftwaffe settled on a mix of Eurofighters and F-35As to fulfil the ECR and nuclear roles. After the German government gave the go-ahead on November 29, 2023, Airbus confirmed that it would develop a dedicated SEAD variant of the Typhoon, dubbed Eurofighter *Elektronischer Kampf* (EK). The initial purchase is for 15 ‘Step1’ aircraft to be NATO-certified by 2030. Built from retrofitted Tranche 2, 3 and 4 aircraft and equipped with a Saab Arexis ELS and AGM-88E Advanced Anti-Radiation Guided Missiles, they will replace the Tornado ECR.

Commander of the Luftwaffe's Air Forces Command Lt Gen Günter Katz has declared that the Luftwaffe is already considering a ‘Step 2’ enhancement programme to “further enhance the Eurofighter's electronic warfare capability”. He added: “Our vision ranges from escort jammer pods to man-unmanned teaming (MUM-T) solutions, which are currently being worked out in co-operation with our industry partners.”

Nuclear mission

Two recent factors are impacting TaktLwG 33's continuing nuclear mission. The US has recently introduced an updated version of its veteran B-61 nuclear weapon, in service since 1967, the new B61-12. This device has a lower yield than its predecessors and can be delivered in ballistic or guided modes.

The new weapon has undergone a re-certification process to ensure the B61-12 can be safely carried by the dual-capable aircraft that could be required to use it: the F-15E, F-16 (MLU), F-35A and German

Above: A test shape B61-12, underneath a WTD 61 Tornado at Edwards AFB in September 2024 Task Force 23

Left: Maj Gen Derek France, HQ USAFE, in a HAS at Büchel AB where the 7501st Munition Support Squadron has custody of the B61 nuclear bombs stored there for TaktLwG 33's alert Tornados USAF/SRA Jovante Johnson



Tornado. At least one German Tornado has been spotted in the US trialling test shapes of the new weapon.

In December 2022, Germany contracted for 35 F-35As to replace the Tornado in the nuclear role. The possibility of purchasing more aircraft is under consideration, with a further eight frequently mentioned during the summer of 2024. Announced as the most cost-effective solution, with many other NATO member states purchasing the F-35A, it offers economies of scale and substantial operational commonalities. US authorities publicly disclosed the clearance for the F-35A to carry the B61-12 in March 2024.

Work to allow the smooth introduction of the F-35A in Luftwaffe service at Büchel is already well under way and necessitated a

Below: A TaktLwG 33 Tornado is pushed back into a shelter at Nörvenich. From June 2022, the base has become the wing's temporary home, while major reconstruction work takes place at Büchel in preparation for the arrival of the F-35A Bundeswehr/Andreas Zeitler

Service life extension

A substantial service life extension programme on the Tornado intended to keep the aircraft airborne until 2030 is being undertaken at the Airbus plant at Manching. For example, having accumulated 5,400 flight hours, TaktLwG 33 Tornado 43+42 was approaching permanent grounding. In addition to flying from Büchel, it had operated from Holloman AFB in the USA for several years, training Luftwaffe Tornado crews.

On May 24, 2017, it was flown to Manching to the Airbus Defence and Space site with its hangar space

for 20 Tornados. Once there, the external wing tanks and pylons were removed, the aircraft's paint was stripped and the airframe was checked for external damage. Six Luftwaffe personnel and 14 Airbus employees dismantled almost the entire aircraft. They checked the condition of the Tornado's structural components and refurbished and replaced parts where necessary. Once the aircraft was rebuilt, it returned to Büchel in March 2021 and is now cleared for up to 8,000 flight hours and expected to remain in service until the intended 2030 out-of-service date.



At the Manching plant, electrical wiring is ongoing on one aircraft, while Tornado 45+14 is prepared for structural work Airbus

temporary move for TaktLwG 33's Tornados, as Col Chris explained: "There is major ongoing construction work here. The runway is being completely rebuilt, taxiways resurfaced and improvements to the base's lighting and domestic infrastructure are being made. As a result, we temporarily ceased flying from there in 2022, transferring operations to the Eurofighter base at Nörvenich, about an hour's drive away. We expect to return to full operations from Büchel in 2026.

"We plan on operating Tornados until the F-35A arrives from 2027 onwards. Because we hold a nuclear role, we cannot gradually reduce Tornado operations as we approach the out-of-service date. We will maintain the capability to fully meet our nuclear commitments until a final date is fixed when the F-35s will take over those responsibilities. Our challenge is maintaining our Tornados' fully operational status until that date." **afm**





Last of the

Patrick Roegies, Paul Gross and Ben Gorski recently spoke to Major Sky 'Comet' Lesh of the 47th Fighter Squadron 'Dogpatchers' about the objectives of the latest Exercise Hawgsmoke – possibly the last large-scale gathering of A-10 units

“Brrrrrrrrrt... brrrrrrrt..!” The silence over the Barry M Goldwater Range in Arizona is shattered by the unique sound of 65 shells per second leaving the Gatling GAU-8 cannon of a Republic A-10C Thunderbolt II. It is a sight, but mainly a sound, that anyone who has ever witnessed it will remember forever. And many such memories were made during the 2024 edition of the biennial US Air Force Hawgsmoke gunnery competition.

For four decades, the A-10 has been a proven and reliable platform for the combat air support (CAS) role. During the First Gulf War (1990-1991) the A-10 proved its value in an actual combat scenario. With air superiority as an umbrella the A-10 ensured ground troops could advance by taking out any potential threat opposing the coalition forces. Some 25 years later, the aircraft still fulfils an important role in CAS with no newcomer in sight.

The A-10 community gathers every two years for Exercise Hawgsmoke with the intention to share experiences, align tactics and successfully complete the Hawgsmoke competition.

Where there's smoke...

In early 2000, it was likely that Hawgsmoke would be abandoned and the air force gunnery competition would not be revived. However, Hawgsmoke adapted and was opened up to every A-10 unit in the Air National Guard, operational Air Force and Air Force Reserves; and the Hawgsmoke exercise continued to evolve through its experiences.

The first Hawgsmoke didn't include many of the events now part of the competition. Initial formation flights were flown as two-ships, changing to today's four-ships and so the exercise kept evolving.

Vision, mission, purpose, necessity

Hawgsmoke traces its heritage back to the Gunsmoke exercise – officially known as the Air Force Worldwide Gunnery Competition – a biennial air-to-surface gunnery meet for conventional weapons, hosted by the USAF. It originated in 1949 and was eventually succeeded by today's exercise.

Major Sky 'Comet' Lesh of the 47th Fighter Squadron 'Dogpatchers' explained:

“Hawgsmoke is the current biennial United States Air Force bombing, missile and tactical gunnery competition for A-10 Thunderbolt II units. The exercise is hosted by the winners of the previous competition and provides both skills competitions and an opportunity to share in the camaraderie and fellowship of the A-10 community.

“The inaugural Hawgsmoke was organised in 2000 at the Alpena Combat Readiness Training Center in Michigan. It was hosted by the 172nd Fighter Squadron from Battle Creek Michigan with Colonel Clifford 'Cliff' Latta initiating the first-ever event.

“The primary purpose remains to increase the tactical skills of the Hawg driver community. The competition would emphasise flying parameters and tactics that may have been relegated to the background prior to Low-Altitude Safety Targeting Enhancement (LASTE). For example, teams and individuals would lose points for releasing their bombs below a realistic abort altitude. Before LASTE, Hawg pilots were released to fly lower to increase their chance of getting a better bomb score. From



Three A-10Cs assigned to the 190th Fighter Squadron 'Skull Bangers' in a formation flight of three aircraft lining up for the tanker Jason Wong

gunfighters

Hawgsmoke 2000 onwards, Hawg pilots were also penalised for exceeding the five seconds on final limit and for not performing the proper safe escape manoeuvre. These Hawg friendly tactical events, also saw the likes of long-range strafe and low-altitude Maverick attacks.

"Another purpose for the drills from Hawgsmoke 2000 edition onwards was to establish a biennial event where former A-10 pilots could meet to exchange experiences with the new generation keeping the fighter pilot traditions alive and to honour their fallen comrades in the now-famous Reading of the List Ceremony.

"The third purpose of Hawgsmoke is to allow current A-10 pilots an opportunity to show their capabilities and ability to master their aircraft. The goal behind gathering all A-10 units is to have a low-key fighter pilot weekend with fellow Hawg drivers, which just happens to have a competition attached."

However, it is most likely the Hawgsmoke 2024 edition was the last, due to the approaching withdrawal from use of the A-10C. For this edition, the 47th Fighter Squadron

hosted – the 'Dogpatchers' are also referred to as the 'Termites' of Davis-Monthan Air Force Base, Arizona.

Operational challenges

Major Lesh commented on the greatest challenges an A-10 pilot experiences when operating the A-10 in a modern combat environment: "The A-10 has continued to

Bullets are spraying out as the 75th Fighter Squadron Hawg driver releases its burst towards the target Christian Beye



prove itself as a lethal attack asset over the many years of service and varying combat environments. However, the adversary air forces are continuously developing and changing their tactics. With that development our armament and tactics must evolve equally to maintain our lethality.

"Our weapons officers and test squadrons have relentlessly kept this mission at the



Hawgsmoke editions			
Year	Organising unit	Location	Unit emblem
1998	172nd Fighter Squadron	Battle Creek Air National Guard Base, Michigan	
2000	118th Fighter Squadron	Bradley Air National Guard Base, Connecticut	
2002	47th Fighter Squadron	Davis-Monthan Air Force Base, Arizona	
2004	No event		
2006	303rd Fighter Squadron	Whiteman AFB, Missouri	
2008	190th Fighter Squadron	Gowen Field Air National Guard Base, Idaho	
2010	190th Fighter Squadron	Gowen Field Air National Guard Base, Idaho	
2012	357th Fighter Squadron	Davis-Monthan Air Force Base, Arizona	
2014	47th Fighter Squadron	Davis-Monthan Air Force Base, Arizona	
2016	47th Fighter Squadron	Davis-Monthan Air Force Base, Arizona	
2018	74th Fighter Squadron	Moody Air Force Base, Georgia	
2020/21	190th Fighter Squadron	Gowen Field Air National Guard Base, Idaho	
2022	190th Fighter Squadron	Gowen Field Air National Guard Base, Idaho	
2024	47th Fighter Squadron	Davis-Monthan Air Force Base, Arizona	



Above: Many aircraft arriving at Davis-Monthan Air Force Base for Hawgsmoke 2024 were those assigned to the 422nd Test & Evaluation Squadron based at Nellis Air Force Base, Nevada. This aircraft is clearly used for operational testing of new innovations to the aircraft Aaron Paxton

Right: A relatively clean 76th Fighter Squadron ‘Vanguards’ banking away from the tanker after refuelling. The aircraft needed to be refuelled multiple times during their transition flight to Davis-Monthan Air Force Base Jason Wong

Below: The ‘Sandy 1’ mission is the toughest to fly as it puts the aircraft in a vulnerable position. Tactics are developed and trained to ensure the job is done and the survivability for the Hawg driver and personnel on the ground is as effective and safe as possible Christian Beye

forefront while maintaining the foundation of what it means to be a Hawg pilot and combat air support expert. Therefore, we consider Hawgsmoke to be just a small example of the versatility and criticality of our critical mission.”

He discussed key lessons learnt from the latest competition and how they are applicable to current or future combat operations, particularly in joint or contested environments: “This year’s Hawgsmoke showcased the first GBU-39 small diameter bomb tactical competition. We have strived to keep the A-10 with the latest and greatest munitions that will bring the fight to the enemy.”

Score!

During the exercise, each participant’s results were scored and rated. Major Lesh explained the process: “The host unit’s weapons officer is normally in charge of creating the event. The 2024 edition of Hawgsmoke was no different. The 47th Fighter Squadron weapons officer put together the entire plan. He forwarded the overall plan to each participating unit at the same time. The projected scenarios make it so

that the actual layout of the range and location really does not matter, and the advantage is minimal. The scoring process is accomplished by multiple weapons officers from across the Hawg communities to guarantee no favoritism in the scoring.

“Each squadron participates with four aircraft and the final score per four-ship depends on the results achieved in three different ways of deploying weapons – dropping the unguided GBU-39 small diameter bombs, firing the AGM-65 Maverick and the firing of the drill cannon. For all three deployments, special targets have been placed on the range course. For dropping the bombs, there are two passes where a minimum height has been set, below which the bombs may no longer be dropped. For firing the on-board cannon, there are four passes where a burst is given at two different targets. Here too, a minimum height applies, and lines have been drawn in the course with white car tyres beyond which no more shooting is allowed. A number of factors such as the flight height and the evasive





For Hawgsmoke, the competitors receive mission details at a set time prior to execution, so the brief and mission preparation are vital to having a chance at winning Patrick Roegies

action afterwards are boundary conditions that affect the final score. Several weapons instructors assess the results in order to reach a final conclusion that is as transparent as possible.”

Tactical debriefing and lessons learned is a critical part of every operation. Major Lesh shared what were the most important takeaways or improvements identified after key events, such as the low-altitude tactical navigation (LATN) or combat search and rescue (CSAR) exercises: “A debrief is often more critical than a brief in gathering the lessons learned and making the necessary changes to guarantee following missions’ success. However, in the Hawgsmoke competition, the competitors receive the mission details at a set time prior to execution, so the brief and mission preparation are vital to having a chance at winning. The debrief is less critical since everything has already been recorded, so it’s more about the bragging rights following the award ceremony.

“From the very beginning as Hawg wingmen, we train extensively in a low-altitude environment. First earning our 500ft qualification. This qualification is followed by a two-ship flight leads training where we earn our 300ft qualification, and finally our 100ft qualification as experienced flight leads. Needless to say, no matter how often you

train to find specific targets at 100ft altitude, while travelling 350mph over the ground it is no easy task. Mission planning at ‘1g’ is critical to identifying the funnelling features that we utilise to get our eyes in the target area when it matters most. No matter the planning, however, the risks of operating at low altitude are always higher, and our contracts and standards helps to minimise this risk.”

The Longest Stick

The AGM-65 Maverick ‘Longest Stick’ challenge highlights the A-10’s standoff capabilities and defines the tactical considerations for extended standoff engagement. Maj Lesh explained the tactical considerations when deciding to employ munitions from such extended ranges, and how the benefits of standoff distance are weighed against potential limitations in sensor fidelity or target confirmation.

“Hitting long-range precision targets with the AGM-65 Maverick at distances of over nine nautical miles is no small feat. Several factors both situational and technical need to be considered when determining the optimal shot parameters.

“The AGM-65 Maverick has proven itself repeatedly in combat ever since Desert Storm. The Maverick still proves to be the



Hawgsmoke 2024 participants

Unit	Tailcode	Home base	Emblem
25th Fighter Squadron	OS	Osan Air Force Base	
47th Fighter Squadron	DP	Davis-Monthan Air Force Base	
66th Weapons Squadron	WA	Nellis Air Force Base	
74th Fighter Squadron	FT	Moody Air Force Base	
75th Fighter Squadron	FT	Moody Air Force Base	
76th Fighter Squadron	FT	Moody Air Force Base	
104th Fighter Squadron	MD	Warfield Air National Guard Base	
107th Fighter Squadron	MI	Selfridge Air National Guard Base	
190th Fighter Squadron	ID	Gowen Field Air National Guard Base	
303rd Fighter Squadron	KC	Whiteman Air Force Base	
354th Fighter Squadron	DM	Davis-Monthan Air Force Base	
357th Fighter Squadron	DM	Davis-Monthan Air Force Base	
358th Fighter Squadron	KC	Whiteman Air Force Base	
422nd Test & Evaluation Squadron	ET	Nellis Air Force Base	

go-to weapon when combatting armour vehicles, especially when it comes to standoff. This is why brand new Hawg pilots are trained early on the Maverick and it remains in our daily tactical mission set. It is often a favourite in the Hawgsmoke competition in trying to get the longest shot. A lot goes into a successful Maverick launch/ firing – atmospheric, run in direction, dive angle, shadowing, and in the overall health of the training Maverick sensor, all determine whether or not you will successfully lock up the target at the longest range.”



Above: A Hawg driver assigned to the 25th Fighter Squadron prepares for start-up Paul Gross

Below: Two Osan Hawgs waiting for taxi clearance Paul Gross

maintaining accuracy with 60°, 45°, 30° and 20° profiles: "Manual bombing is a skill that is practised less and less as the munitions have developed and been upgraded on the A-10.

Manual delivery

However, decreasing manual bomb delivery accuracy is still practised, too. Without the use of constantly computed bomb sights, manual bomb delivery requires a deeper understanding of aircraft ballistics and wind factors. Manual deliveries during the Hawgsmoke competition are still included and scored. Maj Lesh commented on the techniques critical to

However, many A-10 pilots still practise this proficiency in the off-chance the aircraft has an issue where only manual bombing will allow for the employment of the weapon. Without getting too deep into the details, a decent amount of maths, skill and a bit of luck goes into a shack of a manual bomb."

The employment of the GBU-39 small diameter bomb represents a significant evolution in the A-10's capabilities. He discussed how the introduction of this munition changed the approach to tactical employment in both the competition and in real-world scenarios: "The A-10 weapons officers and test pilots have relentlessly strived to keep the A-10 equipped with the latest and greatest munitions that will bring the fight to the adversaries. Practising these capabilities, even in the parameters of a biennial Hawgsmoke competition, still provide the opportunities to refine our skills. This year's Hawgsmoke event showcased the first GBU-39 small diameter bomb tactical competition. The standoff capability that the GBU-39 offers is unmatched with any other weapon the A-10 carries. Bringing this weapon into our daily training habits will only improve our lethality and versatility in combat."

The CSAR mission demands rapid situational assessment, especially under the stress of potential communications interference. Maj Lesh told how a Hawg driver manages the task of identifying legitimate survivor signals while





Above: Artwork on a 25th Fighter Squadron Republic A-10C Thunderbolt II Paul Gross

Right: Evasive action is also part of the strafing run score equal to an actual combat situation Patrick Roegies

navigating spoofed communications, and what tactical procedures are prioritised to ensure the mission success: “It’s no small and easy task as ‘Sandy 1’ to lead in the recovery of an objective, which in most cases is a downed pilot. This is why the ‘Sandy 1’ upgrade is one of the more challenging upgrades you can have as an A-10 pilot. Not all instructors hold the patch. One of the many challenges you receive in the upgrade is deciphering multiple spoofer communications while in flight and working through identifying the objective of the foe. The United States Air Force has certain techniques to achieve this, but it still does not make it easy in a hostile environment with lives on the line.

“The CSAR role remains one of the A-10’s most crucial but challenging missions.” When it comes to prioritising the elements of finding, fixing and authenticating survivors while maintaining situational awareness in a potentially hostile environment, he explained: “The CSAR mission is complex and dynamic in nature. No CSAR is equal to the other and Hawgsmoke is no different. Fortunately, the roles are broken up between the formations with ‘Sandy 1-4’ given specific roles. Each pilot has a task to accomplish in the mission of locating and or recovering the objective. The Hawgsmoke competition replicates this mission on a much smaller scale, but still brings the challenge of time constraints and new environments to the competitors.”

Tactical flexibility in dynamic scenarios

The Hawgsmoke exercise tests pilots across a range of tactical scenarios, as Lesh explained:

“Hawgsmoke is designed to capture all the mission sets that A-10 pilots train to on a day-to-day basis. The challenge lies in the fact that you are executing all of these missions in



one set event, where everything is scored and timed. Each team must work together and use their expertise to not only finish the competition but win it all! The 47th Fighter Squadron put forward our A-squad of attack pilots and I am proud to announce our squadron came out on top overall in the 2024 event.”

Precision timing and formation co-ordination

Ensuring time-on-target precision while co-ordinating with a formation in a situational dynamic airspace requires detailed communication and planning. Lesh described how an A-10 crew manages to synchronise these variables, and what adjustments are made in-flight to stay within the narrow timing constraints of the competition: “Time-on-target precision is practised in multiple different mission sets; from simultaneous weapon impacts to off-target de-confliction in the low-altitude environment, to making a flyover at the World Series at the end of the National Anthem. Hawg pilots learn early on how to utilise and integrate the A-10’s basic timing logic and put it to tactical use when it matters most. It is for this reason that the Hawgsmoke competition uses timing as a big part of the overall score and deduction if not met.”

With multiple events back-to-back, Hawgsmoke presented a high-tempo environment. Lesh told how the Hawg drivers adapt to these fast-paced scenarios: “If you don’t put yourself in high-stress situations in training, then when you find yourself in those situations when actual lives are on the line, you might not be able to execute. Hawg pilots thrive on intensive training, with complicated and stressful scenarios. The more ‘tools in our toolkit’ that we can learn in training, the more we may utilise when the mission demands itself in combat.”

Effective crew co-ordination is paramount in multi-ship missions: “The A-10 community prides itself on adhering to techniques and standards that are accepted across all Hawg

squadrons. As a result, any mission-ready wingman should be able to fly on the wing of any flight lead and successfully employ in combat. The 47th FS Hawgsmoke team was made up of four very experienced instructor pilots. However, there was still only one flight lead.”

Big shoes to fill

He continued: “The A-10 has proven itself in the CSAR task for over four decades. The Hawg history books have shown us how Hawg pilots have risked their lives to accomplish the mission of bringing home the good guys. Although we do operate off a minimum equipment list (MEL) in order to launch, we have seen many instances where pilots have risked it all and taken a damaged aircraft into the fight in order to save lives.”

When the A-10 is withdrawn from use, the gap in combat air support and combat search and rescue (CAS and CSAR) needs to be filled. These are big shoes to fill and the air force is still studying this answer. The A-10 has a legendary CAS and CSAR history and is not easily replaced. Davis-Monthan Air Force Base is expected to host a new Air Force Special Operations Command Wing and will continue to host multiple modernised flying missions to include the EA-37B and HH-60W. Given the importance of CAS to joint operations, future CAS requirements are being carefully re-examined at the defence department level.

The A-10 has continued to prove itself as a lethal attack asset over the many years of service and varying combat environments. Maj Lesh said: “Our weapons officers and test squadrons have relentlessly kept this mission at the forefront while maintaining the foundation of what it means to be a Hawg pilot and CAS expert. Hawgsmoke is just a small example of the versatility and criticality of our mission. Integration in the bigger fight is a necessity that our leaders do not take lightly, which is why the A-10 continues to participate in joint exercises across the globe.” **afm**

Gunning for glory

Approximately 1,000 military personnel, 30 helicopter and 260 vehicles, including 21 armoured vehicles took part in a successful edition of Baccarat last autumn. François Nôtre reports

Despite challenging weather conditions that led to the cancellation of several missions, the sixth edition of the Baccarat exercise was conducted in a highly realistic environment in the Grand East region of France, from October 4 to 15. Since its inception in 2017, Baccarat has evolved to include the participation of various allied units, notably from Spain and the former British Joint Helicopter Command (JHC), though their absence was noted in the 2024 exercise. A significant highlight of Baccarat 2024 was the integration of Mini-Unmanned Aerial Systems (MUAS) from the British Army into the French forces, highlighting the importance of interoperability in NATO operations.

Key objectives

Organised by the 4th Air Mobility Combat Brigade (4e BAC) of the French Army Aviation (Aviation Légère de l'Armée de Terre – ALAT), the aim of this major exercise was to train French forces along with allied forces to operate in depth, far from the rear lines (up to 180km), against an enemy with technological parity. The exercise was conducted for the first time within the Deep Action and Intelligence Command (CAPR) from a field operation Centre (OC) temporarily set up at Etain-Rouvre ALAT base (3rd RHC).

Last September, CAPR Command was officially established in response to feedback from the high-intensity conflict in Ukraine,

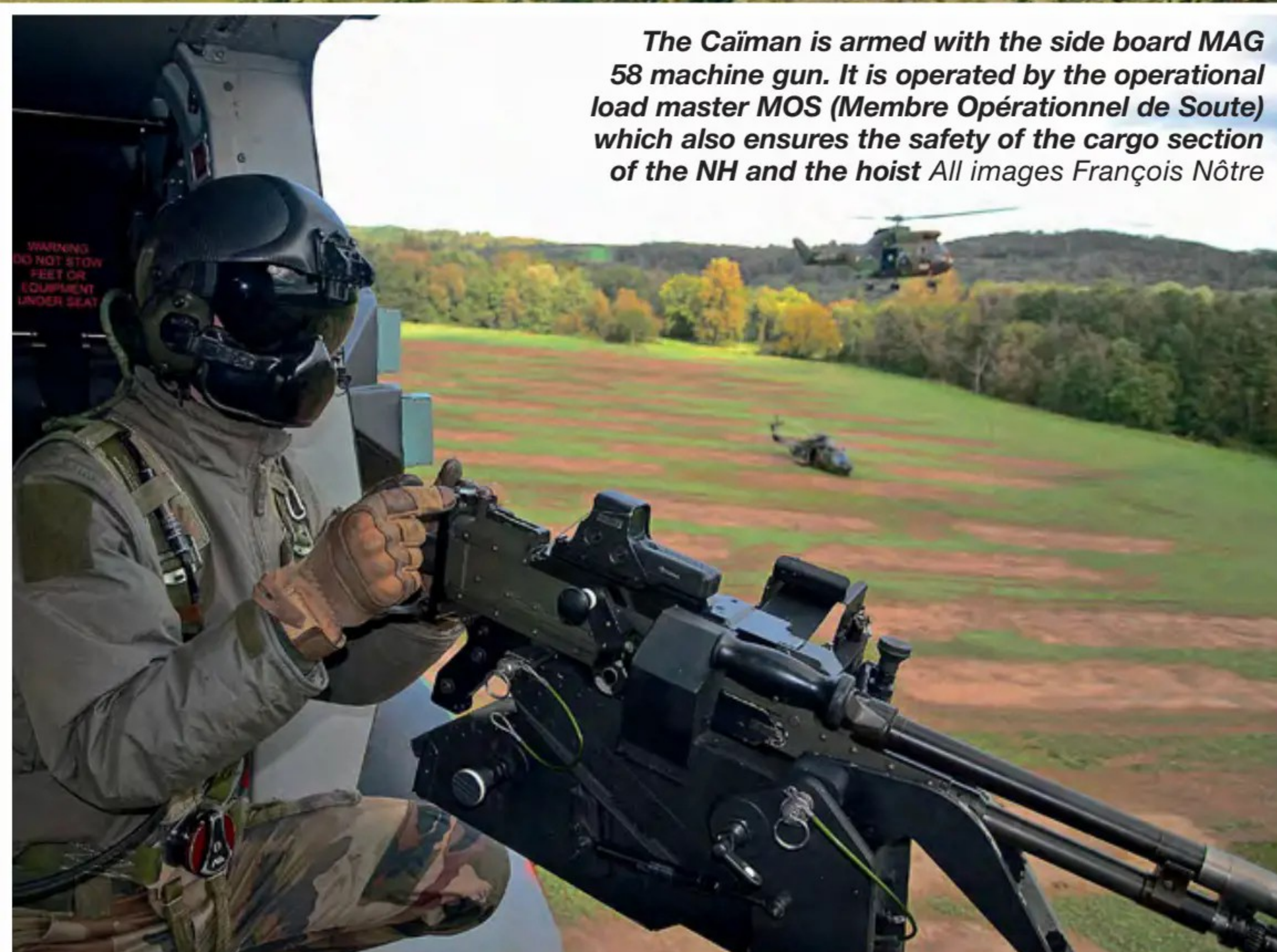
which has provided several key lessons to military forces. The objective is to strengthen the French army's ability to act in the depth of enemy territory (from 30 to 500km behind front lines) by using units specialised in intelligence, artillery, and air mobility. The CAPR is organised around the Ground Intelligence Centre (CRT), the 4th BAC, the 19th Artillery Brigade (19th BART), and the Intelligence and Cyber-Electronics Brigade (BRCE). The forces involved also included fighter aircraft from the French Air and Space Force (FASF), intelligence units, commando units, infantry, and combat engineers, as well as operational logistics units to provide transport, maintenance, fuel supply (FARP),



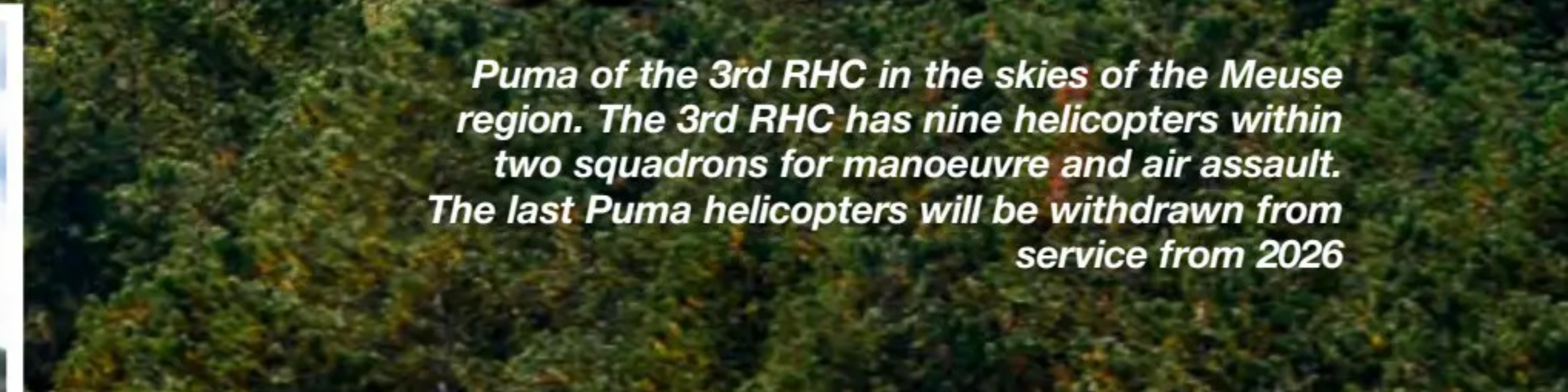
This 3rd RHC Caïman crew from the 2nd EHMA of Etain are equipped with the TopOwl helmet. During Baccarat 2024, they carried out numerous sorties such as air assault operations, logistical transports, medical evacuations, commando airropes or Imex alerts (recovery of a downed crew)



The Caïman is armed with the side board MAG 58 machine gun. It is operated by the operational load master MOS (Membre Opérationnel de Soute) which also ensures the safety of the cargo section of the NH and the hoist All images François Nôtre



Puma of the 3rd RHC in the skies of the Meuse region. The 3rd RHC has nine helicopters within two squadrons for manoeuvre and air assault. The last Puma helicopters will be withdrawn from service from 2026



One of the highlights of the exercise was the integration of British Puma drones from the 32nd Regiment Royal Artillery within the French Army elements

and medical support for the soldiers and equipment deployed.

As General Casanova at the head of the 4th BAC explained, Baccarat 2024 is an important milestone in the preparation for the Diodore exercise, scheduled for March 2025. This exercise marked the debut of the newly established Command of Deep Actions and Intelligence (CAPR). The main objective of CAPR is to shorten the intelligence-decision-fire loop by integrating all contributing functions into a cohesive command structure.

The BAC will participate, providing staff personnel in particular, but also its command, transmission and air combat support company. Baccarat is also a milestone in the preparation of the Dacian Spring exercise in Romania, scheduled for spring 2025. Only a mixed airmobile subgroup (SGAM) will be projected, but this projection is a first on this scale and in this NATO environment. But, more broadly, 2024 was a pivotal year for the 4th BAC. First, it is the end of a 30-year cycle

of operations, which saw the brigade's units involved in all French operations, notably in Afghanistan and the Sahel. For the first time this year, no BAC unit is deployed on a long-term external operation. It was also the 70th anniversary of the Army's light aviation, created in 1954.

In addition to consolidating the brigade's combined-arms skills and know-how, Baccarat 24 was aimed at co-ordinating and conducting actions in the depth of the battlefield, in joint forces with NATO partners. Specific tactical sequences were set up with the FASF to execute SEAD (Suppression of Enemy Air Defence) missions. The exercise also aims to strengthen 3D co-ordination, making a particular effort on drone-helicopter co-operation, through the work carried out with a British PUMA drone detachment.

Baccarat focuses on using the 4th BAC in the depth of the battlefield, aligning with the brigade's preferred strategy for employment

and this aspect is not entirely new. The previous Warfighter exercise, in 2021, had demonstrated that the operational depth of the battlefield needed to be improved upon. Disrupting the enemy's system in depth is crucial for achieving operational success. By targeting key objectives like command posts, ground-to-air defences, and logistical hubs, friendly forces can significantly weaken the enemy's combat capabilities, thus ensuring better engagement conditions for their own units.

In this context, numerous exercises made it possible to experiment the use of the BAC as a subordinate unit within the Rapid Reaction Corps France (CRR-Fr), leading to the NATO certification in early 2024. The latest edition of Baccarat is a continuation of this entire series of exercises. This access to depth constitutes a first tactical challenge. In this area, the analysis of current conflicts, particularly in

Exercise Report Baccarat 2024

Ukraine, shows that the 3rd dimension (3D) is particularly contested, characterised by a very solid, meshed, and multi-layered ground-to-air defence. While the principles of combined arms operations remain similar to those developed during the Cold War, modern equipment and technology have revolutionised how these operations are conducted.

The difficulty of managing a 3D operational space is significantly heightened by the diverse array of friendly flying objects, each varying in size, speed, and altitude. This crowded environment, combined with the control exerted by numerous and diverse units, adds layers of complexity. This makes interoperability with allies not just beneficial but essential.

The units involved

Baccarat 2024 set the stage for a high-intensity war exercise where the objective was to reclaim NATO allied territory occupied by an enemy force from the East. Regaining control over key infrastructures, such as bridges, from the enemy was part of the exercise. Establishing an operation centre (OC) allowed staff from the CAPR and 4th BAC to effectively direct and co-ordinate



Deep fire and contact combat are the Tiger HAD's preferred areas. This 1st RHC helicopter from Phalsbourg carries a rocket launcher and a Hellfire missile. The Tiger HAD can engage targets at 8km, the range of the Hellfire



the operations while remaining secure from enemy jamming capabilities. Legionnaires of the 13th DBLE played the role of the Adversary Force (FORAD) against the 27e BIM (Mountain Infantry Brigade). Most helicopters operated from four different Expeditionary Airfields (EAF) in the region with the 9th RSAM providing logistical support and helicopter heavy maintenance. Cougar, Puma and NH90 helicopters from the 3rd and 5th RHC carried out different operations to infiltrate and exfiltrate groups of commandos (GCM 13 or GCP 11) but also to transport some troop supply. Nearly 30% of tactical flights were carried out in the dark, including on the darkest nights of level 5. 1st RHC Tiger HAD helicopters provided escort duties and close air support engaging targets

with anti-armour Hellfire missile or launching 68mm rockets (all simulated). Fire support was also dealt by the 3rd RHC Gazelle helicopters (HOT missiles or 68mm/70mm rockets) including one SA342 Gazelle 'Gatling' armed with the M134 machine gun for landing zone reconnaissance. For their tactical situation awareness, upgraded Gazelle helicopters used their SIT-ALAT on-board system (Système d'Information Terminal), operational since 2015. The SIT was also integrated on all 5th RHC Cougar helicopters, as part of the Battlespace Digitization program or NEB (Numérisation de l'Espace de Bataille). It gives a real-time 3D view of the battlefield from GPS positions to the helicopter crews and to

32nd Regiment Royal Artillery

The 32nd Regiment Royal Artillery, also known as the Wessex Gunners, is the only Royal Artillery unit equipped with Mini-Unmanned Aerial Systems (MUAS). The regiment is based at Larkhill, Wiltshire, beside the Royal School of Artillery (RSA), on the south edge of the Salisbury Plain Training Area. As part of the Future Soldier Programme, the regiment gained an additional MUAS battery in 2023 and in May 2024, following a re-organisation, the regiment joined the new Joint Aviation Command (JAC), providing AeroVironment RQ-20 Puma drones as part of its MUAS capabilities. The Puma drone is used for intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) missions. It provides real-time aerial reconnaissance and can operate in various environments, making it a valuable asset for the regiment.

The Joint Helicopter Command (JHC), now known as the Joint Aviation Command (JAC), is a tri-service organization within the British Armed Forces. It was established in 1999, and its primary role is to command and co-ordinate battlefield helicopters and unmanned aerial vehicles (UAVs) from the Army Air Corps (AAC), Royal Navy's Fleet Air Arm (FAA), and the Royal Air Force (RAF).

In December 2022, it was announced that more than 250 mini drones would be delivered to the Armed Forces under a contract worth £129 million with Lockheed Martin UK. Since 2024, the regiment has been assessing the Stalker VXE30 and Indago 4 UAS under the Army's TIQUILA Programme (ISTAR) from Lockheed Martin UK. Finally, the 32nd RA has a long history of overseas operations (Gulf War, Afghanistan) and deployments. The most recent is its NATO Enhanced Forward Presence in Estonia and Poland, contributing to the security and stability of the region. Also different various training exercises in Kenya, Japan and Canada provide valuable experience to its personnel.



A Caiman performs an immediate take-off from rough ground after dropping off a mountain commando section. The NH-90 helicopter now constitutes the backbone of the Army's tactical air transport capabilities

the chain of command, avoiding the use of radio communications. Enemy threats are also recorded beforehand by the mission planners. The system is compatible with the Tiger and Caiman helicopters and to the latest Combat Information System Scorpion (SICS) that equipped new French Army armoured vehicles (Griffon, Jaguar, Serval). The more advanced SICS-ALAT battle management system is due in 2026 and will be the next step towards the modernisation of the French Army's combat capabilities. Many combat scenarios were set up to maximise the integration of the British Puma MUAS from the 32nd Regiment Royal Artillery in the 'tactical bubble'. The RQ-20 Puma, along with the SMDR drones from the 61st Artillery Regiment, were used for reconnaissance, surveillance and target acquisition to the ground unit.

Drones in the battlefield

Drones have truly transformed modern warfare with almost endless applications. According to the General Casanova, the ALAT and the BAC in particular, have intensified their efforts in this field. The first step is to systematically integrate and use nano-drones, currently used by all Army units. He said: "We must also make better use of drones, particularly specialised ones, which are in service with others, for example within intelligence units or allied units. This helicopter-drone co-operation was certainly already implemented during operations in the Sahel-Saharan strip but must now be adapted to the specific needs of high intensity. Finally, we are working so that drones can be used as an extension of helicopter capabilities, in intelligence and destruction missions (remotely operated munitions), but also in a deception manoeuvre (decoy drones), or even as laser illuminators."

In short, drones have enormous potential to reinforce the effects of the air combat



To celebrate the 70th anniversary of the ALAT, a special commemorative scheme was painted on a NH-90 helicopter from the 5th Régiment d'Hélicoptères de Combat (5th RHC) based in Pau, southwest France

manoeuvre, while increasing the survivability of helicopters. These are therefore particularly stimulating prospects that are emerging for the BAC. All these efforts will

ensure that the French Army remains at the forefront of drone technology, capable of leveraging these versatile tools for a variety of operational needs. [afm](#)

Baccarat 2024 participants

	4th Air Mobility Combat Brigade (4e BAC) Based at Clermont-Ferrand		
	Base	Helicopter type/ Escadrille	Number (can varied)
1st RHC Combat Helicopter Regiment (Régiment d'Hélicoptères de Combat)	Phalsbourg	EC665 Tigre / 1st + 2nd EHRA (Attack/ Recce) NH90 Caïman / 1st + 3rd + 4th EHMA (Manoeuvre/Assault) SA342M/M1 Gazelle / 3rd EHRA (Attack/ Recce)	12 18 9
3rd RHC Combat Helicopter Regiment (Régiment d'Hélicoptères de Combat)	Etain-Rouvre	SA342M/M1 Gazelle / 1st + 2nd + 3rd EHRA (Attack/Recce) SA-330 Puma / 1st + 3rd EHMA (Manoeuvre/ Assault) NH90 Caïman / 2nd EHMA (Manoeuvre/ Assault)	15 9 6-8
5th RHC Combat Helicopter Regiment (Régiment d'Hélicoptères de Combat)	Pau-Uzein	EC665 Tigre / 2nd 3rd EHRA (Attack/Recce) NH90 Caïman / 1st + 2nd EHMA (Manoeuvre/Assault) SA342M/M1 Gazelle / 1st EHRA (Attack/ Recce) SA-532 Cougar /3rd EHMA (Manoeuvre/ Assault)	12 12 9 9
9e RSAM Air mobile Support Regiment	Montauban	Pilatus PC-6 (Aircraft transport for field maintenance support)	5
4th Air Combat Command and Transmission Company	Clermont- Ferrand	N/A	

*Mil Mi-24 helicopter similar to those acquired by Col Tim Spicer for his Sandline mercenary operations in Africa and Papua New Guinea. In Sierra Leone, Ellis ended flying these gunships against rebel concentrations.
All images Al Venter Collection*



At the ‘sharp end’ for half a century

Former South African Air Force Commandant **Neall Ellis**, a British national, is now the world’s longest serving still-active mercenary pilot. Al Venter details his extraordinary career flying helicopter gunships

It is almost exactly a half century since a youthful Rhodesian by the name of Neall Ellis, having completed his helicopter conversion in 1975 in South Africa, was told that he had been chosen to fly combat in Rhodesia’s bush war. He was to be seconded to the Royal Rhodesian Air Force 7 Squadron for two months.

As he says, it was all very hush-hush – South African pilots sent to help a rebel British colony that had unilaterally declared itself independent fighting guerrillas in an ongoing African liberation war.

“We were briefed at Light Aircraft Command, in those days located at the Swartkop air base on the outskirts of Pretoria and told we couldn’t take any documentation or clothing that would identify us as South African military, and most important, none of us should speak Afrikaans, especially in public.

“That was actually a bit of a laugh because some of the aviators deployed with us could barely speak English: most had heavy Afrikaans accents.

After a short welcome speech at Salisbury’s New Sarum Air Base, we were issued with

Rhodesian army camouflage uniforms and identification documents. The next couple of days were spent preparing for deployment after which I was assigned to the Mtoko Fire Force flying a ‘G-Car’, effectively an Alouette III trooper.

“It was a remote region to the east of Salisbury, the Rhodesian capital, and there were few sorties that did not result in exchanges of fire with guerrilla insurgents. The first few missions were not easy, in part because I was not familiar with the rugged terrain. Also, Rhodesia’s flying procedures and culture were quite different to those used by the SAAF [South African Air Force].

“For example, we would be flying along, and the destination would abruptly be changed in flight. Then too, my helicopter

Neall Ellis prepares for an Mi-24 sortie in the Sierra Leone jungle



having no autopilot, we'd switch to a totally new set of flight plans without landing to draw lines on a map.

"There was no GPS in those days and navigation was strictly map reading, heading and keeping to strict timelines because of fuel..."

He went on: "My first contact with the guerrilla force that opposed our presence

was my taking a small squad of black troops attached to the Rhodesian African Rifles into a contact. They were four seated behind me and it wasn't long before we came under fire, both a challenging and noisy experience that at the time had me thinking I was flying into wires. It was only when I spotted the agitated look on the faces of the others on board that I realised

the crackling sounds all round us were enemy bullet salvos.

"We were hit, several rounds passing just behind my head and in front of the soldier sitting directly behind me. I recall the exhilaration when we landed; I had found my niche, something that only those who enjoy combat can relate to. Our fuselage sported more than a dozen hits.

"It was notable that the Alouette IIIs we flew were originally purchased by the Rhodesians pre-UDI [Unilateral Declaration of Independence]. Not long afterwards, still more were covertly obtained from various sources, some from Spain or France and others from South Africa. Most went towards replenishing gunships lost in accidents or in combat."

The sharp end

Experience at the so-called 'sharp end' led the Rhodesians to remove all but the pilot's door on their 'G-Cars' and to reverse the front passenger seat to widen the available floor space and gain flexibility. With the doors removed, it was easier for troops to be dropped directly into battle.

The standard Sud Aviation front seats in the 'G-Car' were replaced in the Rhodesian Air Force by a 'homemade' rear-facing bench seat. While carrying troops, casualties on a stretcher could be carried laterally across the rear of the cabin, one on the floor and another stretcher on a rack above it. The adaptation was primitive, but in the process many lives were saved.

One bit of history not made public until after that war ended was that a Rhodesian



A Hind preparing for jungle sortie at the Freetown Air Wing base

50 years flying gunships

Alouette III 'K-Car' had the distinction of using its 20mm cannon to shoot down a Botswana Defence Force Islander on August 9, 1979.

Looking back, Ellis reckons that few people have had as much hot metal thrown at them as he had. He has been involved in one conflict or another almost continuously since leaving university in his early twenties.

After being dismissed from the Rhodesian Army (he completed only half the required hours for an officer's course) he joined the South African Air Force and went on to fly jets, helicopter transports, and gunships in the Namibian and Angolan border wars.

At the end of that phase, he had achieved the rank of half-colonel and was then told by his white bosses in Pretoria – shortly after South Africa's first democratic post-apartheid elections – that there was no place for him in Nelson Mandela's new order.

Rhodesian War

Ellis (also known by the nickname Nellis) was to learn most of the basics of combat flying in the Rhodesian War, almost all of it linked to legendary Fire Force operations where the chopper dropped troops literally onto the heads of guerrillas fighting in the bush below.

It was notable, he recalls, that Fire Force as a military concept dated from 1974 when the Rhodesian Air Force acquired the French MG-151 20mm cannon from the Portuguese.

Prior to that, traditional counter-insurgency tactics of follow-ups, tracking and ambushing simply weren't producing satisfactory results. So, the Rhodesians went on to expand on the idea of a 'vertical envelopment' of the enemy – first practised by SAS paratroopers in Mozambique in 1973 – using the 20mm cannon as the principal weapon of attack.

In support would be several Alouette G-Cars – usually with 7.62mm machine guns mounted out the left-hand door – as well as propeller-driven ground-attack aircraft armed with front guns, pods of napalm, white phosphorus rockets and a variety of Rhodesian-designed bombs.

On call, should additional firepower be needed, were Canberra bombers, Hawker Hunter and Vampire jets.

Private Military Company Hips at Bagram air base in Kabul which was also Ellis's base



Dodging SAMs

South Africa's 23-year-long Border War followed Ellis's Rhodesian stint where cumulatively, on hundreds of missions, he ended up – still flying Alouettes – often deep in the interior of Angola.

He reckons too that in the latter stages of conflict, he must have dodged a dozen Soviet SAM-7s. Those were the ones he physically spotted on combat missions. "There were probably quite a few more that passed behind my rotors. But we'd quickly worked out evading tactics, with the result that not a single SAAF helicopter – Puma or Alouette – was brought down by missiles. In contrast, quite a few helicopters were taken out by ground fire, mainly heavy stuff, like 12.7mm and 14.5mm."

During its 23 years of border conflict the SAAF lost five Alouettes from enemy engagement and obviously a couple more from accidents, technical and pilot error. There were also four Pumas downed and one from own forces fire (Operation Savannah). It is notable that not one helicopter was taken out by SAM supersonic missiles which, towards the end, were fielded in

considerable numbers in Angola, courtesy of the Soviet Union.

It was not that SAM-7s (or Strelas, their NATO designation) were no good; essentially it was the tactics employed by both the South Africans and Portuguese forces in Africa that prevented them from being effective.

It was also during the Border War that Ellis was at the receiving end of three Strelas fired at his Alouette during a three- or four-hour contact that left 300 SWAPO (South West Africa People's Organisation) guerrillas dead: the single deadliest battle of the entire war.



From the rear of an Mi-24 Hind helicopter gunship – one of the two rocket pods carried by the gunship





That action took place in the exposed, arid terrain in the Kaokoveld, close to the Angolan border. Major Ellis (as he then was) only had a second or two to react after spotting the metres-long flashes from the missiles as they were being launched and, though evasive reaction time was minimal, the warheads swept past within metres of his machine. They were obviously not armed with proximity fuses like those fitted to later versions of these MANPADs (Man-Portable Air-Defence Systems).

Still circling the area, his engineer was able to knock out the launch sites on the ground with his 20mm heavy machine gun.



Ellis and his Arab side-gunner Hassan Delbani with Russian weapons catalogues on his desk

Throughout all these African wars, it was notable that though lightweight, underpowered and comparatively low speed, these tiny aircraft were able to take a remarkable amount of punishment from triple-A ground fire. Most times, they managed to return to base, occasionally with their tail booms or a rotor hanging by a thread.

At the end of it, the Border War having ended after almost half a century of hostilities,

Ellis decided to move on and become a freelance combat pilot.

Gun for hire

His first contract as a mercenary was with the illogically named Executive Outcomes, battling insurgency in Angola, followed by a deteriorating conflict in the Congo which ended when Ellis had to escape by hijacking a canoe which then sunk after coming under fire from the shore by his pursuers. He had to swim for his life across the great river into the Central African Republic where he was rescued by a French Foreign Legion patrol operating out of Bangui.

Several more wars followed, including flying Mi-8 for Muslim Bosnian forces in the Balkans, Liberian operations during that civil war, and a contract fighting drugged-up terrorists in Sierra Leone. That was followed by a three-year operational support mission in Afghanistan and deployment into northern Somalia to counter the piracy menace.

Thereafter, as he recalls, he was in Azerbaijan during 2016 when the Nagorno-Karabakh conflict took place.

Gunship pilot/lifesaver

It was in the Sierra Leone civil war of the 1990s that this veteran helicopter gunship pilot emerged in his African milieu as a lifesaver.

Having been hired to fly a Soviet Mi-17 (initially blooded in Sierra Leone) by Tim Spicer, an ex-Lieutenant Colonel in the Scots Guards, founder of Sandline International, a private military contractor (PMC). That contract went sour when the company



Executive Outcomes Mi-17 in African operations in Africa. Ellis flew for this Private Military Company for a while



Alouette gunship pilot Ellis (second on right) with flight crew in Somalia where he served independently for three years

was exposed for clandestinely sending weapons to the Sierra Leone Government. Almost overnight the Sandline contract was terminated and, unable to pay Ellis cash, Spicer gave the mercenary aviator the *Hip* helicopter he had been flying out of Freetown.

By then the rebels were at the gates of the Sierra Leone capital and Ellis, together with former British SAS operator Fred Marafano and his Lebanese side-gunner Hassan Delbani (a Hezbollah stalwart), used the chopper to rescue many hundreds of civilians wishing to escape hostilities.

Those operations, almost always taking place at night, were hazardous in the extreme, with Marafano and Delbani having to fight off rebel groups during just about every rescue effort. At the end of it, the industrious three made a healthy profit by the time that Britain decided to send troops (headed by the illustrious Brigadier David Richards) to Freetown to counter rebel advances.

The then Sierra Leone government refused to pay the outstanding contract fees and the team had to settle for less than a third of what the government owed them.

Also notable is the fact that over many months and thousands of rounds fired at them, they were not wounded once...

The situation that prevailed at the time can best be illustrated by one of the more bizarre events of the final stages of the last rebel uprising. A Nigerian unit operating at the front arrested a man who was found with a bag of hands and feet cut from children. His haul also included a leg or two. When asked what it was all about, he admitted that his commander had told him that if he could fill the bag with limbs, he would be promoted to captain.

Combat missions

It was then that I joined the Neall Ellis crew at their Cockerill Barracks in the heart of the Aberdeen military base on the outskirts of Freetown, Sierra Leone. For several months thereafter I flew combat with the team in one of a pair of former Soviet Mi-24s.

The routine each time we went out, was to settle myself under the front bubble of

the *Hind*, from where I was able to capture thousands of images of the ongoing conflict. Indeed, it was an instructive and, at times, extremely hazardous experience.

At the heart of just about everything that took place in Sierra Leone's war in 2000 was the Air Wing operations room at Cockerill Barracks. More properly known as the Corps Operations

Centre, it was a home away from home for this unconventional band of mercenaries. An untidy place that had a certain disordered charm about it, the barracks was a combination office, social club, intelligence clearing house, telephone answering service, map room and conference centre.

By Nellis' own admission, his domain at Army Headquarters in Cockerill Barracks "kind of ran itself". Two or three times a day he would liaise with his bosses upstairs and things would start to happen. For a long time Nellis was on his own, fending off the occasional crisis and making do with what was available.

However, it wasn't long before Whitehall appointed a Royal Air Force squadron leader to 'supervise' the Nellis' Air Wing team. The project was handled under a guise they termed their 'Sierra Leone military training program'. This was a shrewd move designed to avoid having the RAF linked in Parliament (or anywhere else) to Sierra Leone's low-key but prominent mercenary force.

Situated well away from the main block at Army Headquarters, Ellis' expansive, sparsely furnished ground floor office was visited by as many senior British officers in camouflage as there were top Sierra Leonian army commanders in situ. Britain's Special Air Service was also part of the mix, with Ellis flying them to remote areas where they would become active.



Ellis in his *Hind* worked in tandem with the three RAF Chinooks operating in the Sierra Leone war

In spite of working closely with Brigadier Richard Davis, Ellis was clearly regarded as a mercenary in London's eyes – the Ministry of Defence would have quickly abrogated any unofficial arrangement if they had caught wind of it.

Obviously, some of 'the brass' back home knew what was going on, but it was a convenient arrangement while hostilities lasted and the Brits made full use of Ellis's aviation skills because there was nobody else in the country who was as familiar with the jungle terrain, the rivers, the towns and, of course, the Revolutionary United Front guerrillas.

I was always amazed at the way Ellis moved about in a land where there were no navigational or flying aids. There were two rudimentary air traffic control systems in operation in the Freetown area: one for civilian and Air Wing activity centered at Lungi, the other a mobile unit operated by the UN at the chopper pad at the Mammy Yoko Hotel.

Flying in Sierra Leone posed several problems, not least of which was trying to figure out where you were. While there are some fine natural landmarks, especially among the mountains in the north and to the east of the country, a good deal of the south and central region was flat, and it all looked the same.

Elsewhere the terrain was undulating. Though there was always something in sight on the horizon, flying 30ft above the jungle wasn't conducive to good navigation unless it was something that you'd been doing for a while.

Operating directly to and from an objective over this green pea soup of a terrain unquestionably taxed Ellis's skills. Sitting up front, I should have been able to assist him, but I couldn't even begin to help. He was constantly forced to calculate fuel, distance, speed, reserves... and all the rest. And since there were no convenient army bases or towns where we could top up fuel if we needed to, he couldn't afford to make a mistake.

As far as I know, he never did, but then he'd received many warnings from the rebels that if he were to be brought down or land in hostile terrain, they would cut out his heart and eat it.

Methodical preparation

Ellis's approach to combat never varied. Just before a mission his manner was as



A Mi-24 Gunship being prepared for operations over the African jungle. Ellis sometimes flew several such missions a day

calm as if he was going to a movie. Carefully, methodically, he would go through his pre-flight checks, walking around the helicopter, pushing this and tugging at that. He also carefully examined all the spaces inside, which pilots are apt to do when somebody is willing to pay good money to destroy an adversary. (Pipe bombs have killed a few fliers in Africa over the years. One was Bruce McKenzie, Kenya's last white cabinet minister. He was murdered on the orders of Idi Amin with such a device placed in an aircraft that was to have returned him safely back to Nairobi from Entebbe.)

Once this routine was complete, Ellis gathered his ground crew to go over what had been done to the helicopter since his last flight: repairs, replacements, and, most important, what they had *not* been able to fix. We all relied on our Soviet-trained Ethiopian ground and technical crew who, for several years, kept at least one of the two Mi-24s operational.

I once asked Ellis, almost as an afterthought, how he felt about waging nearly daily combat. Things were likely to happen in the end, I suggested.

His reaction was muted, and I don't believe he thought that much about it. He and the crew had been in so many enemy contacts and been fired on so often that they were a bit like Pavlov's hounds, though the work was never mindless.

"Having someone shoot at you can powerfully focus the mind," he laughed, although his eyes told me that he was serious.

One evening, weeks later, after a brief night out, Ellis tossed a paper across the table. "You want to know what it's like? There's part of the answer," he said. He had underlined an obituary notice in one of the British newspapers detailing events associated with the life of Air Vice Marshal Sandy Johnstone.

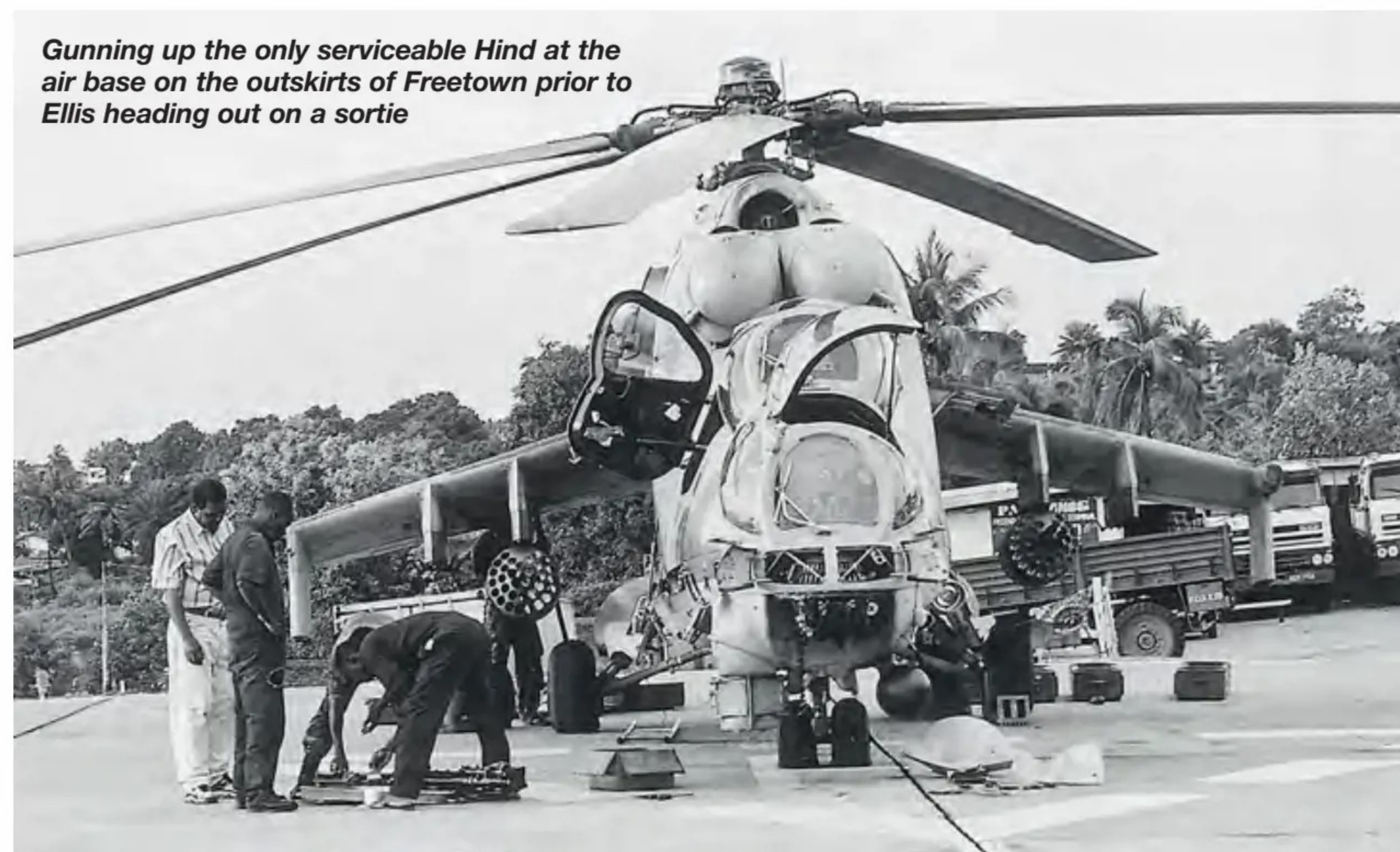
The write-up concerned a Spitfire raid on a chemical factory at Pachino, Sicily in World War II. "It was a strange overwhelming feeling of excitement that made your mouth run dry with the taste of it," explained Johnstone to someone long ago. The quote had come from Johnstone's autobiography.

He was spot on, because that was exactly what happened to me each time we saw action. Whenever I flew with Ellis into an attack and things became dodgy, my hands would tightly grip whatever they had in them at the time, usually my cameras. At the same time, my responses to his orders would quicken and my senses were about as sharp as they've ever been.

Ellis told me once that he and the *Hind* were like one; the aircraft was strapped to his backside, and he flew by the seat of his pants...

Ellis, now well into 70s but as sharp and active as ever, is not considering ending his flying career and is proposing another contract in Africa. "I'll never die in a helicopter," he told me halfway through my stay. He really believed that he was far more likely to croak in a car accident. Africa's roads and drivers being what they are, it made sense. **afm**

Gunship Ace: The Wars of Neall Ellis, Helicopter Pilot and Mercenary: Al J. Venter, Casemate 2018



Gunning up the only serviceable Hind at the air base on the outskirts of Freetown prior to Ellis heading out on a sortie



Natal Air Base (BANT) in Brazil hosted CRUZEX 2024, the ninth edition of the CRUZEX Exercise, consolidating its position as the largest air warfare training exercise in Latin America. With participation from 16 nations, more than 3,000 military personnel, and 100 aircraft, the event showcased multinational military co-ordination,

operational excellence, and technological integration across air, cyber, and space domains. Spanning two weeks from November 3 to 15, the exercise aimed to enhance interoperability among air forces and prepare them for complex real-world challenges, ranging from traditional combat scenarios to emerging threats in the cyber and space realms.

Organised by the Command of Preparation (COMPREP), it sought to advance doctrinal maturity and identify areas for improvement in the training of Air Units (UAe) and Aeronautical Units (UAer). Throughout the exercise, participants engaged in hypothetical scenarios of Regular, Regional, and Limited Warfare, focusing on air force operations.

Battle over Brazil

Latin America's largest simulated air exercise CRUZEX 24 took centre stage in the world of aviation in November at Natal Air Base in Brazil. Giovanni Colla reports

Força Aérea Brasileira (FAB) front line jets in one shot – F-39E, A-1AM and F-5EM
All images Giovanni Colla



A unique formation with all the participants of Exercise CRUZEX 2024 flying over Natal Air Base

Regular Warfare, or conventional warfare, was characterised by direct confrontations between the conventional military forces of two or more states, typically involving formally organised armies and clear divisions. It was the most likely conflict type in territorial or political disputes among nations with traditional armed forces. Regional Warfare referred to disputes that, while potentially having international implications, were confined to a specific region or geographical area. Limited Warfare described conflicts where the use of military force was intentionally restricted, with clearly defined boundaries set by the involved parties. Such conflicts were generally more focused, encompassing specific interventions, localised military operations, or precision strikes using smart munitions.

According to Gen Pedro Luís Farcic, Commander of Preparation, CRUZEX was a vital exercise for the Brazilian Air Force (FAB), particularly with the introduction of new aircraft and technologies. “This exercise

provided an opportunity to strengthen ties with participating allied nations and collaborate on the training of other countries. The logistical planning alone served as a training exercise for us, as we faced the challenge of uniting different squadrons and teams over time at Natal Air Base.

“We involved all necessary sectoral directing bodies to ensure the smooth execution of CRUZEX, from deploying aircraft and equipment to providing support for our participants’ needs. We undoubtedly learned many lessons from this process,” he explained.

Overview and innovations

The exercise consisted of three phases. The first, called FAM (Familiarisation), included familiarisation flights to help crews adapt to the Area of Operations. The second, of FIT (Forces Integration Training), promoted integration among the various

Fuerza Aerea Colombiana (Colombian Air Force) KC-767 Jupiter assigned to Escuadrón de Transporte 811 – El Dorado, Bogotá Air Base, taking off for a morning COMAO mission





Above: FAB E-99M assigned to 2°/6°GAv Segundo Esquadrão do Sexto Grupo de Aviação 'Guardião' takes off from Natal Air Base. That strategic asset provided In-Flight Control and Alarm (CAV) tasks, vital for supporting Composite Air Operations (COMAO)



Left: Fuerza Aerea de Chile (FACH) F-16C-50M assigned to Grupo de Aviación N°3 Base Aérea Los Condores safely landing in Natal after an afternoon sortie. Recently the FACH's most modern F-16s received the same livery colours as the old version of F-16AM/BM in service with V Brigada Aérea (Grupo de Aviación N°7 – Grupo de Aviación N°8)

Bottom: FAB F-5EM, 4864, landing in a beautiful light at Natal Air Base. The type is assigned to 1°/14°GAv Primeiro Esquadrão do Décimo Quarto Grupo de Aviação 'Pampa' – Canoas Air Base





participating air forces, and the final phase featured flights in pre-planned scenarios with multiple aircraft, known as Composite Air Operations (COMAO). Directed by Maj Gen Ricardo Guerra Rezende, Commander of BANT, CRUZEX 2024 aimed to update tactics, techniques, and procedures in composite air operations, preparing the armed forces for conventional warfare scenarios and complex challenges.

With a strong focus on cyber defence, air defence, and satellite control, CRUZEX 2024 became a milestone in preparing and integrating the armed forces of Brazil and its allies, enhancing operational capabilities and fostering essential international co-operation during times of crisis and complex military operations. A key feature of the exercise was the introduction of Cruzex Cyber, a cyber simulation designed to enhance the security of critical systems that supported aerospace operations. Led by the Brazilian Air Force Cyber Defence Centre (CDCAER) and supported by the Brasília Air Force Computing Centre (CCA-BR), Cruzex Cyber uses the Capture the Flag (CTF) format where participating forces were tasked with both protecting and attacking virtual systems.

Above: FAB R-99 assigned to 2º/6ºGAv Segundo Esquadrão do Sexto Grupo de Aviação returns at Natal Air Base after a mission. The R-99 aircraft functions as the Airborne Communication Station (PCOM-AR) during CRUZEX

This approach highlighted the increasing significance of cyber warfare in the modern military landscape, equipping the armed forces to tackle emerging threats in this domain.

In an environment that simulates real cyberattacks, Cruzex Cyber, is more than just a standalone cybersecurity training event: it conducts cyber activities that contribute to air operations. This integration is designed to strengthen combat operations in the airspace, ensuring secure and co-ordinated information exchange between aircraft and command centres. At the core of Cruzex Cyber, the CTF format brings teams of specialists together to handle digital threats that mimic modern conflict situations, such as network intrusions and sensitive data leaks. According to Lt Col Tiago Josue Diedrich, Chief of the Cyber Operations Cell, these simulations, conducted in a controlled cyber environment, allow participants to identify vulnerabilities and respond to attacks in real time. "This training is more than a competition. It is a practical preparation to defend our systems in a scenario where cyber threats are as critical as physical ones," he explained.

The exercise includes advanced activities such as computer analysis, vulnerability exploitation, cryptography, and network traffic analysis. Each team must find, and capture 'flags' hidden within systems, reflecting real-world challenges like attacks on communication and aircraft control systems. Cyber integration marks a significant change in military training by allowing air forces from different countries – such as Brazil, Colombia, Paraguay, Peru, and the United States – to work together, facing complex threats with a modern and collaborative approach. "This exercise goes beyond technical training. It is an international cooperation experience that enhances cybersecurity and strengthens the capacity to give joint responses to threats," said Capt Oswaldo Segundo da Costa Neto, a participant from CDCAER.

The synergy between cyber and air operations provides the armed forces with greater precision and intelligence, with real-time data enabling immediate route adjustments, quickly identifying

FAB A-1AM, 5523, assigned to 1º/10ºGAv Primeiro Esquadrão do Décimo Grupo de Aviação 'Poker' lands at Natal Air Base





Above: Força Aérea Portuguesa (FAP) KC-390 assigned to Esquadra 506 'Rinocerontes' taxiing for a mission. FAP currently operates two KC-390s (26901 and 26902) with the latest one delivered in June 2024

threats, and preventing fratricide – situations where friendly forces are accidentally hit. In a real conflict scenario, the integration of cyber defence and air operations could determine the success of a mission, minimising resource usage and optimising strategy execution. In addition to its strategic importance, Cruzex Cyber, also represents a substantial resource-saving opportunity, allowing pilots and digital security teams to face simulated threats in a virtual environment. This approach reduces the need for expensive physical training, fuel and ammunition consumption, and preserves the aircraft's flight hours, making resource use more efficient and targeted.

Rezende commented on the relevance of these innovations for strengthening the capabilities of the Brazilian Armed Forces and their allies, as well as for fostering international co-operation in uncertain times. "The introduction of the cyber domain and the diversity of aircraft enhanced our capabilities and ensured we were prepared for current and future challenges," he concluded.

The participants

For the Brazilian Air Force, the exercise showcased various aircraft, such as the F-39 Gripen, F-5EM, A-1, A-29B fighters, C-105/SC-105 Amazonas transport aircraft,



Brazilian Navy AF-1C Skyhawk, N-1021, assigned to VF-1 Primeiro Esquadrão de Aviação de Intercepção e Ataque – São Pedro da Aldeia Air Base returns after a morning mission



KC-390 Millennium, E-99M, and H-36 Caracal helicopter, as well as the A4 from the Brazilian Navy. Argentina with IA-63 Pampa and KC-130H; Chile with KC-135 and F-16; Colombia with KC-767; the United States with F-15 and KC-46 (767); Paraguay with AT-27 and C-212; Peru with KA-1P and KC-130; and Portugal with KC-390.

Maj Gen Nelson Pardo Ocaranza, Commander of the Chilean Air Force Group

that participated in CRUZEX 2024, highlighted the exercise's significance and the challenges it presented for his Force. "Given the scale of the structure and the resources involved in CRUZEX, this exercise enabled the Chilean Air Force to strengthen interoperability with the other participating air forces. It enhanced our operational readiness while enriching the exchange of knowledge and experiences in utilising air power in a multi-domain environment, all within NATO planning methodologies. Undoubtedly, CRUZEX was an opportunity that reinforced the bonds among participating forces, validating the importance of creating operational spaces for a common purpose," he stated.

During the exercise, the FAB demonstrated the capabilities of its newest fighter aircraft, the F-39, in international air combat scenarios. The F-39 was involved in Air Opposition Operations, co-ordinated by the Air Defence Package Leader. This fighter is equipped with advanced self-defence systems, including a Radar Warning Receiver (RWR), Infrared Search and Track (IRST), and Missile Approach Warning System (MAWS), essential for detecting and countering threats. Scenarios during the exercise required quick reaction capabilities, known as 'Threat Reaction', testing the F-39's responsiveness. The fighter was evaluated during advanced tactical missions, performing both offensive (Offensive Counter Air, OCA) and defensive (Defensive Counter Air, DCA) operations. Lt Col Ramon Lincoln Santos Forneas, Commander of the First Air Defence Group (1º GDA), explained that CRUZEX pilots trained as both enemy and allied forces, with the latter being their primary role. "In



FAA IA-63 Pampa III, A-712, assigned to Grupo Aéreo 10 de Caza – Rio Gallegos Air Base flying over the Atlantic Ocean, close to Natal.

this context, we executed Offensive Counter Air (OCA) missions, where the F-39 Gripen will protect friendly forces operating in enemy territory, as well as Defensive Counter Air (DCA) operations to defend against enemy attacks."

Another key aspect during the two weeks of exercise was to evaluate the F-39's combat survivability using the Mission Planning Assistance II (PMA II) system. This system



FAB KC-390, FAB 2859, flying over the Atlantic, off the coast of Natal. The type is assigned to 1º GTT Primeiro Grupo de Transporte de Tropa, Anápolis Air Base

simulates the impact of potential threats and analyses the performance of each participating aircraft. "CRUZEX 2024 is a critical test for the F-39 Gripen, solidifying its strategic role in national defence and providing a clearer picture of its adaptability and resilience in modern combat settings" stated the GDA Commander.

Composite Air Operations

The COMAO phase was the highlight of CRUZEX, where Brazilian and allied forces co-ordinate air combat actions in a high-pressure, high-risk environment. These composite air operations were planned to be carried out within compressed timeframes, requiring participants to be highly organised and skilled to operate effectively in a combat scenario. The co-operation among the participating nations demonstrates the critical importance of interoperability in achieving strategic objectives.

Col Ricardo Bevilaqua Mendes, Head of the Operational Preparation Division of the Preparation Command (COMPREP) and Head of the Exercise Control Division (EXCON) at

CRUZEX 2024, emphasised the importance of COMAO in the exercise. "COMAO is the flagship mission. In this type of operation, several aircraft launch simultaneously, utilising a temporary air defence gap that enables entry into the simulated enemy territory. This setup allows for the completion of key missions such as strikes and personnel or cargo airdrops. The support of air defence aircraft is essential for achieving planned efficiency and effectiveness," he explained.

The two weeks of COMAO were structured with scenarios that became more complex day by day featuring new scenarios with heightened operational complexity and additional challenges. Throughout the exercise, artificial limitations were also imposed on aircraft capabilities, which forced pilots to develop creative solutions to accomplish their missions. According to the Exercise Director, the training methodology reduced aircraft capabilities as the exercise progresses, balancing them out and challenging pilots in their planning and decision-making. This approach allows the development of doctrinal capabilities in



A beautiful formation comprising a FAB F-39E and a USAF F-15C



Fuerza Aérea De Chile (FACH) F-16D-50M side by side with a US Air Force F-15C

the E-99 and R-99 aircraft provided advanced monitoring and reconnaissance, delivering real-time data that ensures operational coordination and security. “Our role in CRUZEX is to ensure clear communication and radar visibility for all aircraft in the exercise area. We collaborate with ground teams to provide training and ensure all safety protocols are met,” he explained.

Capt Marcio Luiz Melo Bonin, Air Traffic Control Specialist and Chief of the Third Military Operations Centre (COPM3), highlighted that these missions facilitate efficient co-ordination and communication among all those participating in COMAO. This enhances the operational capabilities of friendly aircraft in both combat and incursions. “The operations take place in diverse environments, with aircraft operating at extreme altitudes and others at very low levels, necessitating precise co-ordination and control to ensure mission



A Fuerza Aérea Paraguaya AT-27 assigned to ‘Escuadrón Guaraní’, at CRUZEX 2024. The squadron was made up of three AT-27 Tucano aircraft and one Casa 212, 13 officers and ten non-commissioned officers. This is the first time that Paraguay actively participated with personnel – it was an observer in 2006, 2008 and 2010



FAB A-29B wearing a special livery in tribute to the 80th anniversary of the 1º Grupo de Aviação de Caça (1º GAVCA). The aircraft was customized with a historic colour scheme that recalls the P-47 Thunderbolt flown by Capt Fortunato Câmara de Oliveira, during the Second World War

simulated scenarios. “These restrictions aim to impose a controlled ‘imbalance of forces’, increasing the complexity of scenarios and enhancing the training. This challenges pilots to innovate and adapt to adverse situations, ultimately improving their operational capabilities,” he explained.

To ensure mission success, Natal Air Base played a pivotal role in co-ordinating security and logistics for the mobilisation and training of participating forces. Specialised logistics and maintenance teams ensure that aircraft and equipment were prepared to meet the high demands of training, supporting smooth and safe flight operations. Co-ordination between crews and the command centre was managed through advanced control and communication systems, such as the Third Integrated Air Defence and Air Traffic Control Centre (CINDACTA III), which oversaw airspace management and facilitates real-time operational supervision. This structure enabled detailed analysis of flights from planning through execution and post-action assessment, ensuring continuous learning and improvement.

Roles of the E-99M and R-99

During CRUZEX 2024, the Brazilian Air Force E-99M aircraft performed In-Flight Control

and Alarm (CAV) tasks, vital for supporting Composite Air Operations (COMAO). Equipped with the advanced ERIEYE airborne radar, the E-99M can detect aircraft over long distances, including those flying at low altitudes, and distinguish between friendly and enemy aircraft. This capability ensures strategic airspace surveillance and control of friendly aircraft operating in the area. Additionally, the FAB network of ground radars extends coverage and monitoring beyond the reach of traditional ground-based systems. The E-99M’s versatility in positioning, coupled with its ability to detect low-altitude traffic, makes it indispensable for covering areas of interest during the exercise, particularly in remote or mountainous regions where fixed radar coverage may be lacking. This capability allows for effective control of aircraft involved in operations, regardless of the ground-based command and control structure.

Meanwhile, the R-99 aircraft functions as the Airborne Communication Station (PCOM-AR) during CRUZEX. Its mission is essential for maintaining communication between aircraft operating in the combat zone and ground control units. Lieutenant Colonel David Dantas da Silva, Commander of the Second Squadron of the Sixth Aviation Group (2º/6º GAV) – Guardian Squadron, emphasises that

success. In this context, the E-99 aircraft serves as a platform for In-Flight Control and Alarm missions, while the R-99 acts as an Airborne Communication Station, among other key operational roles,” he concluded.

KC-390 Millennium in action

Among the key highlights of this edition is the FAB transport aircraft: the KC-390 Millennium, which took part in the exercise for the first time. The FAB’s multi-mission cargo aircraft undertook critical tasks, such as aerial refuelling (REVO), aerial resupply, airdrop assaults – deploying Brazilian Army troops – as well as the infiltration and exfiltration of troops.

“REVO enables other aircraft to extend their range, which is a key factor for prolonged operations and for the success of missions in remote and difficult-to-access areas. The KC-390’s aerial refuelling capability demonstrates its efficiency and indispensable role in extending the operational reach. The KC-390 Millennium has proven to be a ‘state-of-the-art’ aircraft, showcasing its ability to meet the demands of a challenging exercise like CRUZEX,” said Lt Col Umile Coelho Rende, Commander of the First Transport Group (1st/1st GT) – Gordo Squadron. He noted that the aircraft has already been employed in a variety of real-life scenarios,

including aerial firefighting, delivering supplies to the Yanomami community, and transporting essential equipment to support the Brazilian Navy in Antarctica, among other missions. As such, the exercise helps to establish tactical and operational training for the KC-390 in a simulated conflict environment.

“It’s vital to consolidate what we’ve been training in recent years: airdrop assault, low-altitude tactical navigation, and aerial refuelling with fighter aircraft. Putting this into practice is essential, showcasing the KC-390’s versatility in multi-scenario operations. Additionally, the onboard technological platforms enhance crew situational awareness, and the aircraft’s self-protection systems are being tested. This improves our crew capabilities, situational awareness, positioning, and decision-making in complex situations,” Rende said.

Alongside the Brazilian KC-390 was the Portuguese Air Force’s (FAP) KC-390. This marks the first year the Portuguese aircraft joined the exercise, symbolising the strengthening of military co-operation between Brazil and Portugal, and reflecting the growing importance of the KC-390 within global armed forces. Lt Ana Filipa Mota Pires Alves Ferreira, a FAP pilot, emphasised the significance of this participation for both her career and her team. According to her, the presence of the KC-390 represented not only an opportunity for technical and tactical improvement but also a means of reinforcing ties between air forces. “We are here to share knowledge and learn from our Brazilian and international colleagues. This is a unique experience that enhances our operational capabilities and prepares us for complex missions in challenging environments,” she said.

With its multi-mission capabilities, the KC-390 stands out in the exercise due to its versatility, performing both logistical transport and aerial refuelling. Filipa highlighted that training with the aircraft in a multinational environment like CRUZEX allows it to be tested in various scenarios and adapt its procedures in real-time. “This experience is



A close up on a FACH F-16C-50M taxiing back to its spot

enriching because each country has its own approach to operations. We can explore its full capacity for integration and adaptability,” she concluded.

Achievements

During the exercise, approximately 1,500 flight hours were logged, over 450 parachutists were dropped, 160 targets were attacked, and more than 800 missions completed. Operational efficiency reached 98%, reflecting the high level of preparedness of the participating teams. According to Rezende, the Director of CRUZEX 2024, the results surpassed all expectations. “With planning that began in 2022, our goal was to create a highly complex simulation environment while fostering integration beyond aircraft in the skies. We’re talking about an international defence network where trust and co-ordination are essential. Beyond the numbers, the exercise marked an exchange of knowledge on techniques, tactics, and procedures that can save lives and improve air force responses in real-life situations,” he stated.

One of the major triumphs of CRUZEX 2024 was the synergy between military personnel

from various nations, such as Canada, Ecuador, and South Africa. These countries participated as observers in planning and debriefing sessions, analysing each stage of the training and sharing their perspectives aiming at contributing with aerial assets in the next edition of the exercise. This exchange of experiences was crucial for teams to enhance their operations and build a strong network of international cooperation. Aside from creating synergy between the countries, Cruzex has been crucial to the FAB because it served as a grand platform to develop aerial capabilities, showcasing a versatile and skilled fleet. In combat aviation, the Commander of the Air Defence Group (GDA), Forneas, emphasised the performance of the F-39 fighter aircraft. “We had the opportunity to practice complex air combat missions where our pilots developed advanced tactics and improved co-ordination with foreign squadrons, resulting in significant operational gains,” he said. In transport aviation, Rende praised the KC-390 Millennium for its performance in air-to-air refuelling, aerial resupply, aeromedical evacuation, and humanitarian missions. “The KC-390 proved to be a versatile and efficient aircraft, operating in various simulated scenarios and reinforcing its strategic role within the Brazilian Air Force,” he stated.

In reconnaissance aviation, Lt Col David Dantas da Silva highlighted the value of missions with the R-99 and E-99 aircraft, which were essential for real-time data collection. “Strategic reconnaissance was fundamental to the success of operations. We provided detailed combat scenario information, enabling quick and precise decision making,” he noted.

CRUZEX 2024 leaves behind a legacy of learning and international co-operation. “This multinational and complex scenario allowed our pilots to undergo operational training very close to real-life situations, contributing to improving the readiness and response capacity of the Brazilian Air Force,” concluded Rezende. The exercise stands as an example of integration and continuous improvement, paving the way for future editions. The next CRUZEX already stirs anticipation, promising to once again bring together the air forces of various nations for a common goal: building a strong and united global defence. **afm**



FACH F-16D-50M taking off in full reheat for the morning COMAO mission

Belgian Flair

The small airstrip at Leopoldsburg in rural Belgium is an unlikely setting for one of Europe's largest airshows. Yet, since 1977 this relatively unassuming location has played host to one of the continent's best-loved aviation events.

Gordon Duncan reports back from Limburg Province

Essentially two shows rolled into one, in recent years the event has featured a night show in advance of the main airshow. Sanicole is not the easiest location for taking photographs as the display line is due south of the crowd so the night show can offer the best opportunity to shoot flying display participants without the harsh sunlight glare, a natural consequence of the layout. Last September's display featured a splendid roster, with some of Europe's most popular warbird acts helping to mark the 80th Anniversary of the Liberation of Belgium, one of the key themes being celebrated. Both BBMF Lancaster, PA474, and B-17G 'Sally B' took part, with the two venerable machines looking particularly resplendent. These were joined by a host of top

European fast jet solo demos, with standout contributions from the Armée de l'Air et de l'Espace Rafale C, wearing tricolour special markings, and the excellent Finnish Air Force F/A-18C Hornet display, which delivered a punchy routine featuring the liberal use of flares. The 2024 44th edition of the International Sanicole Airshow featured a fine mix of displays across the aviation spectrum, with enough front-line military action to please 'heavy metal' enthusiasts.

Present-day Belgian military strength was represented by both A400M Atlas and NH-90, the 'Caiman' delivering a SAR routine winning a volunteer from the airfield. Belgium's aviation history featured heavily

too; it wouldn't be Sanicole without an appearance by a Fouga CM-170 Magister, and the charismatic little jet, in its colourful 'Red Devils' scheme, was warmly received by the large crowds, though sadly its planned formation with the SF260s of the modern Red Devils was unable to take place – a pity, as this was possibly the last ever Sanicole appearance by the latter.

Another act appearing for almost certainly the last time, the 'Thunder Tigers' of 31

'Tiger' Squadron bowed out with a boisterous showing, their three F-16s charging up and down the airfield in a variety of configurations. The 50th anniversary of the F-16 was another key theme, and the type was very well represented in the flying, with solo displays by the Royal Danish Air Force F-16AM and F-16C 'SoloTurk' display from the Turkish Air Force joining, in a major coup for the event, the USAF Viper Demo Team, flying a borrowed F-16C from the famous



The Rafale C of the French Air and Space Force was a highlight – here catching the last of the sun's rays at Saturday's night show All images Gordon Duncan

A surprise star of the show, the Swedish Hkp16 (UH-60M) put on a wonderfully dynamic routine, enhanced by this mass flare release



'Warhawks' of the 480th Fighter Squadron based at Spangdahlem Airbase in Germany. The 'tactical' nature of the American Viper demo provided a fitting contrast to the more energetic European demos, and together all three more than compensated for the loss, earlier this year, of Belgium's much-loved F-16 display. Not to be outdone, the last ever Belgian F-16 demo pilot, 'Vrieske', was very much present, his own 'Fighting Falcon' spearheading a multinational cohort of F-16s from Denmark, Turkey and Portugal, before joining Spitfire XVI SL721 for a series of flypasts titled 'The Last Dance'.

Further excitement for the fast jet enthusiast was provided by

the Patrouille Suisse in their six F-5E Tiger II aircraft, appearing at this event for quite possibly the last time. The enduring popularity of the Swiss team was reflected in their being tasked with bringing Sunday's main show to a close, and they duly delivered a typically splendid routine in which flares featured prominently. Notable also were two Eurofighter Typhoon demonstrations; the RAF Typhoon FGR4 demonstration in the specially marked camouflage jet was a very late addition to the line-up following the cancellation of the NATO Air Days event in Czechia; it was joined by a Luftwaffe EF2000 from 31 Tactical Wing 'Boelcke' based



Consistently one of Europe's top fast-jet routines, the F/A-18C of the Finnish Air Force put on a spectacular show



The solo F-5E of the Patrouille Suisse entertains the Sanicole crowds with an inverted fast-pass featuring multiple flare releases

at Nörvenich Air Base near Cologne. It used to be the case that German fast jet displays were exceedingly rare; indeed, this Eurofighter demo was the first such routine witnessed here in over 20 years.

Space is tight at Sanicole, with little room for a conventional static display, but there was nonetheless a decent smattering of machines on the ground, with rotary types necessarily featuring heavily. The Royal Netherlands Air Force was present with both NH-90 and AH-64... no ordinary Apache, Q-42 was one of the brand-new Apache Guardian AH-64Es delivered to the RNLAF last year (2024). At the opposite end of the scale, at least in terms of vintage, it was a real treat to see a Dutch PC-7 (L-09) on static display, joining two further examples from the Austrian Air Force, one of which wore particularly

outlandish special markings. The Pilatus stable was also well represented in the flying, with Slovenia contributing their PC-9M 'Hudournik' demonstration; notable for its piloting skill and technical brilliance, this is one of the finest military displays currently on the European circuit. But perhaps the best display of the whole weekend came from a rather unlikely source. We are used to seeing spectacular helicopter demonstrations at airshows, with several European types beautifully illustrating the point, but the Swedish Air Force Hkp16 (UH-60M Black Hawk) display stunned observers with a tight aerobatic routine flown close to the crowd. Such displays from medium-lift helicopters are rare; the impact all the more enhanced by a small venue, and the mass flare dump which featured in the Black Hawk's showing at the Saturday night show.

Like many continental European shows, Sanicole represents excellent value for money. Various ticket packages are available, as well as the facility to pre-order catering, car parking and even the show's souvenir programme. For the keen enthusiast, the €90 'combi' ticket is perhaps the most attractive option, as it provides access to both Sanicole show days, plus the Spotter's Day at nearby Kleine Brogel airbase, where most airshow assets are based over the show weekend. **afm**



This brand-new AH-64E from the Royal Netherlands Air Force was one of the stars of the small but impressive static display

'The Last Dance' – legendary F-16 demo pilot 'Vrieske' was joined by Spitfire XVI SL721 for a series of flypasts to give him the opportunity to bid a proper farewell to the Belgian airshow public



Glorious

Gifu

The Japan Air Self-Defense Force Gifu Air Base in Kakamigahara has hosted the Gifu Air Base Air Festival 2024. Junji Sato reports

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The air festival was staged on November 17, from 8.30am to 3pm. The north and south areas of the base were open to the public and included display flights by Boeing F-15 and Mitsubishi F-2 fighters in their 70th anniversary paint scheme and ground displays of US Marine Corps F/A-18 fighters and aircraft belonging to the Maritime and Ground Self-Defense Forces. This year, 65,000 aircraft enthusiasts from all over Japan and further afield gathered for the last display flight of the Kawasaki C-1 Prototype, 28-1001, at the festival.

The event usually requires winter clothing, but this time it was hot, reaching 23°C during the day.

There was no Blue Impulse flying display at this event, but at the opening ceremony, F-15, 02-8801, made an appearance painted in the red and white Air Development and Test Wing (ADTW) flying colours

to commemorate the 70th anniversary of the Japan Air Self-Defense Force.

Next, a commemorative formation flight by ADTW-affiliated Kawasaki T-4s, F-2s and F-15s was followed by a display by F-2s and F-15s in the blue sky.

A KC-767 air-refuelling aircraft from Komaki Air Base (404 Squadron) then appeared over Gifu Air Base and after twice flying over the area, performed a refuelling mission flight. Mid-morning, the Komatsu Rescue Squadron's UH-60J helicopter performed a rescue demonstration flight. Since January, 2024 there have been many disasters caused by the Noto Peninsula earthquake and heavy rains, and the number of flights by rescue squadrons has reached an all-time high.

ADTW aircraft including the T-4, F-2, F-15 and the C-1 transport – which is being retired – then

KC-767, 87-3601, belonging to Komaki Air Group, 404 Sqn





Kawasaki C-1 Flight Test Bed, 28-1001, making its final public demonstration flight at the air show. The first flight was in 1970



McDonnell Douglas F/A-18C of VMFA-312 'Checkerboards', BuNo165214, based at USMC Iwakuni, performed a display at the end of the day

The ADTW aircraft participating were T-7, T-4, F-2, F-15, C-1 and C-2, making up a large formation of nine aircraft of six different models All images Junji Sato



Mitsubishi F-15DJ, 12-8078, climbing in full afterburn against the blue sky



Mitsubishi F-15J, 32-8942, painted red and white to commemorate the 70th anniversary of the founding of the Japan Air Self-Defense Force and with the 70th anniversary logo

performed in formation, with each aircraft demonstrating its own unique flying routine afterwards.

After lunch, the most popular 'mixed formation' flight at Gifu AB was shown. The ADTW aircraft taking part were Fuji T-7, T-4, F-2, F-15, C-1 and Kawasaki C-2, making up a large formation of nine of six different aircraft

models. The large formation flew over the base three times. Then each aircraft showed off its own unique flight, making the most of its characteristics and fascinating the audience.

At the close, the Ground Self-Defense Force and Maritime Self-Defense Force, which participated in the ground

demonstration, began to return to their bases.

Many spectators waited to see the F/A-18 belonging to the US Marine Corps Iwakuni Base take off. The F/A-18's engine started at around 3.20pm and it took off 15 minutes later then the Hornet performed a high-energy display that wowed the crowd at Gifu. [afm](#)

Training jet tragedy

Babak Taghvaei reports on the tragic circumstances that marked the end of Iran's latest attempt to produce its own training jet

The Iranian Aviation Industries Organization (IAIO), one of the organizers of the 12th edition of the Kish Air Show (December 10-13, 2024), had planned for some of its domestically designed and built aircraft to appear at the event. One of them was the HESA (IAMI) Yasin advanced pilot training (APT) jet.

The second and only airworthy prototype of the aircraft left Shahin-Shahr airport near Isfahan for Kish Island on December 4. En route, the aircraft experienced a double engine failure and crashed in Firouzabad county, south of Shiraz, killing two pilots, Colonel

Hamidreza Ranjbar and Manouchehr Pirzadeh. The Iranian Ministry of Defence and Logistics of Armed Forces (MODAFL) issued a statement hours after the accident, but did not mention the aircraft type.

Designed by the Aviation Industries Research Institute of the IAIO, the Yasin APT jet had its first prototype flown on October 17, 2019. Design flaws resulted in the production of a second prototype, which was unveiled on March 11, 2023, and had its first flight logged on November 18, 2023. While the design and development of the Yasin as the future IRIAF



The second prototype of the Yasin APT jet can be seen at Shahin-Shahr parked next to one of the two IrAn-140T Simorgh tactical transport aircraft. Ali Naderi



Above: The first prototype of the Yasin APT jet was painted in a white colour scheme before the end of its career as a test aircraft in 2022. It was often displayed to the public during open days and airshows at the 1st Tactical Fighter Base of the IRIAF in Tehran. Keyvan Tavakkoli



Above: The second prototype of the Yasin landing at Shahin-Shahr airport after its first flight on November 18, 2023, with pilot Col Hamid-Reza Barzegar at the controls Ali Naderi

Below: The first prototype of the Yasin APT jet lands following its inaugural flight in Tehran on October 17, 2019, flown by Maj Hamid Gorji, who retired in 2022 Keyvan Tavakkoli





Col Manouchehr Pirzadeh, the second test pilot of the Yasin APT jet who lost his life on December 4. He was a former F-5E/F pilot and test pilot in the 41st TFS, and an F-5E Saeghe pilot and test pilot in the 23rd TFS before joining the IAMI Corporation as a test pilot Babak Taghvaei

Faulty ejection seats

Yasin-2 was equipped with a pair of Sarir ejection seats, a modified version of the Zvezda K-36DM built by IAMI/HESA, the same seats installed on Yasin-1 during flight tests. Sarir ejection seats were designed, developed, and built by IAMI in the early 2000s to be installed on F-5Bs of project Simorgh (conversion of F-5As and RF-5As to F-5B). These ejection seats were installed on the second batch of six F-5Bs of the project (the first six had Martin Baker Mk.10Bs) and then were installed on the first F-5F Saeghe II and the first F-5F Kowsar combat trainers (their fuselage and structure were manufactured by IAMI) and finally two seats were installed on the first and then second Yasin prototypes.

On June 1, 2021, the last F-5B of the project Simorgh (12th aircraft, '3-7026B') had its Sarir ejection seats accidentally activated during engine start inside a hardened aircraft shelter in 4th Tactical Fighter Base (4th TFB) 'Vahdati' in Dezful killing its student pilot, 1st Lieutenant Hossein Namani, and instructor pilot Major Kianoush Basati. Immediately after that, the Department of Inspection and Safety of the IRIAF issued a directive resulting in the temporary withdrawal the F-5F Saeghe II and the five remaining F-5Bs of project Simorgh, leaving only the first six F-5Bs of the project and four original F-5B Freedom Fighters in service of the 43rd Combat Crew Training Squadron (CCTS) in 4th TFB.

The small number of ten F-5Bs left in service of the 43rd CCTS, as well as a small number of airworthy FT-7Ns in 8th TFB Babaei in Isfahan, were not sufficient to meet the needs of the IRIAF for APT jets. As the design and development of Yasin encountered delays, the IRIAF finally acquired Yak-130s from Russia in 2023 to primarily use them for Su-35SE pilot training and then to train graduates of the 82nd Undergraduate Pilot Training (UPT) Squadron, future MiG-29 and Su-24MK pilots.

With the crash of the second Yasin prototype in December, it is possible the Kowsar-88 project has the same fate as the IRIAF's project Ya-Hossein, resulting in the procurement of additional Yak-130 jet trainers for the IRIAF to also train pilots for its 3rd Generation fighter jets. **afm**



deliveries of the first starting in the summer of 2023. While the Yak-130s were intended to be used specifically for Su-35SE pilot training in Iran, the Yasin was to supplement the IRIAF's small fleet of Northrop F-5B Freedom Fighter and Chengdu FT-7N Airguard APT jets for the training of future fighter pilots of third-generation fighters, F-5E/Fs, and F-4Es.

Catastrophe for the Yasin

Ranjbar and Pirzadeh, former F-5E/F Saeghe I/II pilots of the IRIAF's 23rd Tactical Fighter Squadron (TFS) were tasked with performing the ferry flight of the second prototype of Yasin to Kish Island. They left Shahin-Shahr airport around 1130hrs local time, heading south. Just 50km south of Shiraz, the aircraft experienced double engine failure and subsequently double electric generator systems failure, resulting in the pilots' inability to even use their radio. The aircraft entered a flat spin then impacted the mountainous area. Minutes after the crash, the IRIAF's 71st Search and Rescue Squadron at 7th TFB Dowran in Shiraz scrambled a Bell 214C towards the crash site. They discovered the pilots' bodies inside the aircraft wreckage, indicating their failure to use ejection seats.

An Aerospace Engineer from the IAIO's Aviation Industries Research Institute, involved in the design and production of Yasin, spoke to the author on condition of anonymity. He said: "Yasin-2 was still undergoing test flights and did not have a proper certificate of airworthiness, even as an experimental aircraft, to be allowed to perform a cross-country flight or take part in the Kish Airshow and perform demonstration flights there. Despite this, Second Brigadier General Reza Khaki from the IRIAF, head of the Research Institute, and Mehdi Gougardchian, CEO of IAMI/HESA [Iranian Aircraft Manufacturing Industries] corporation, persisted in the participation of the aircraft in the Kish Air Show."

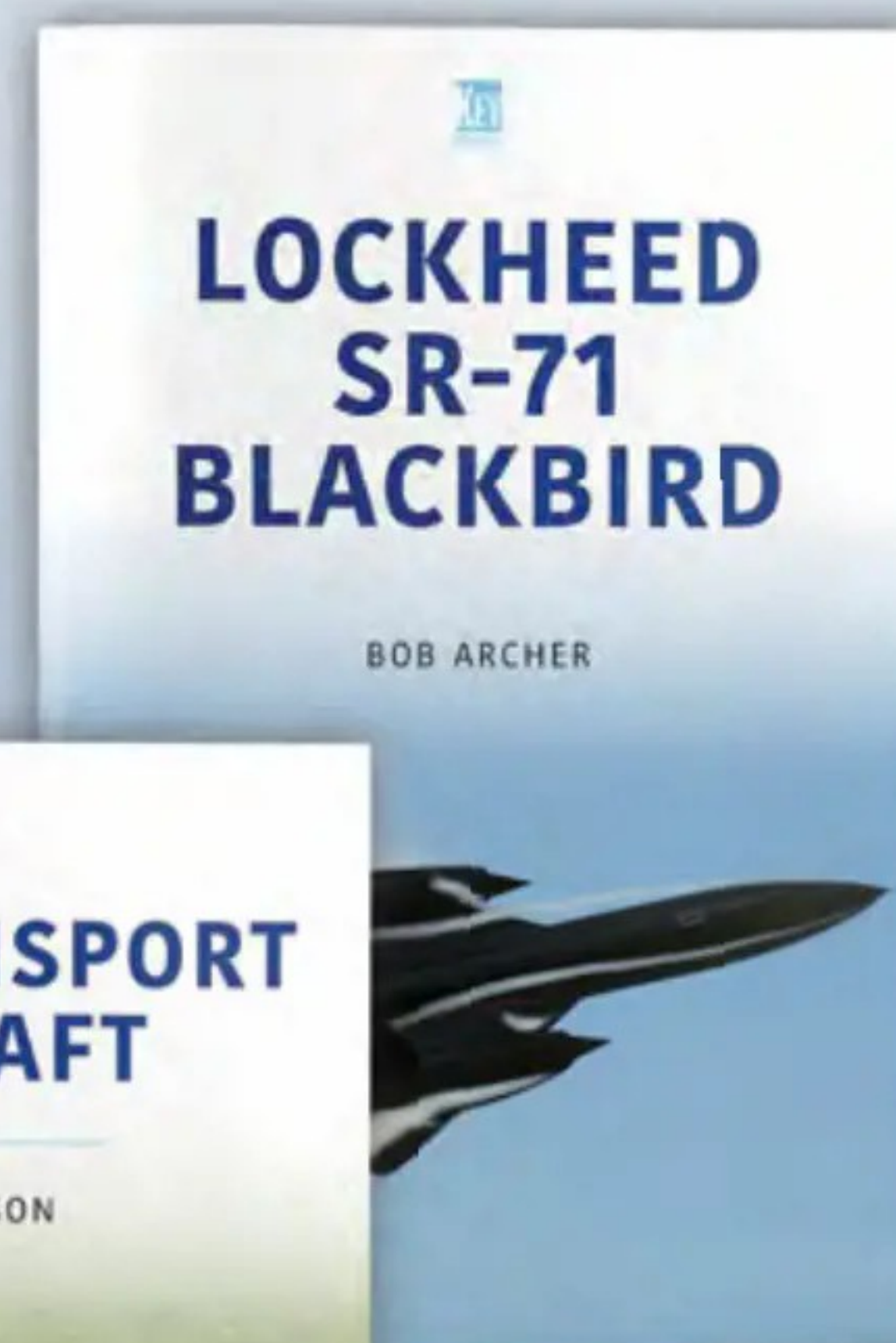
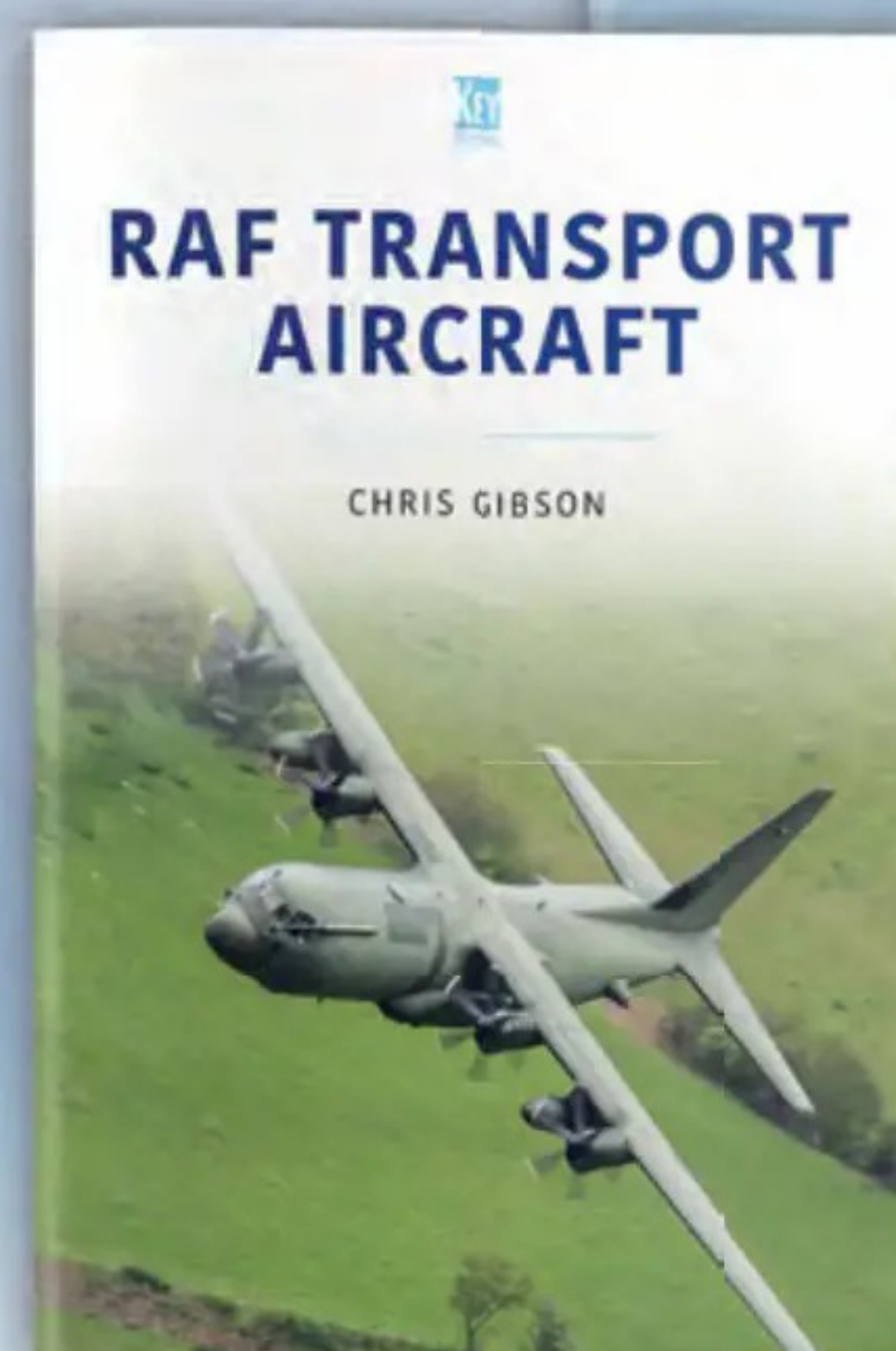
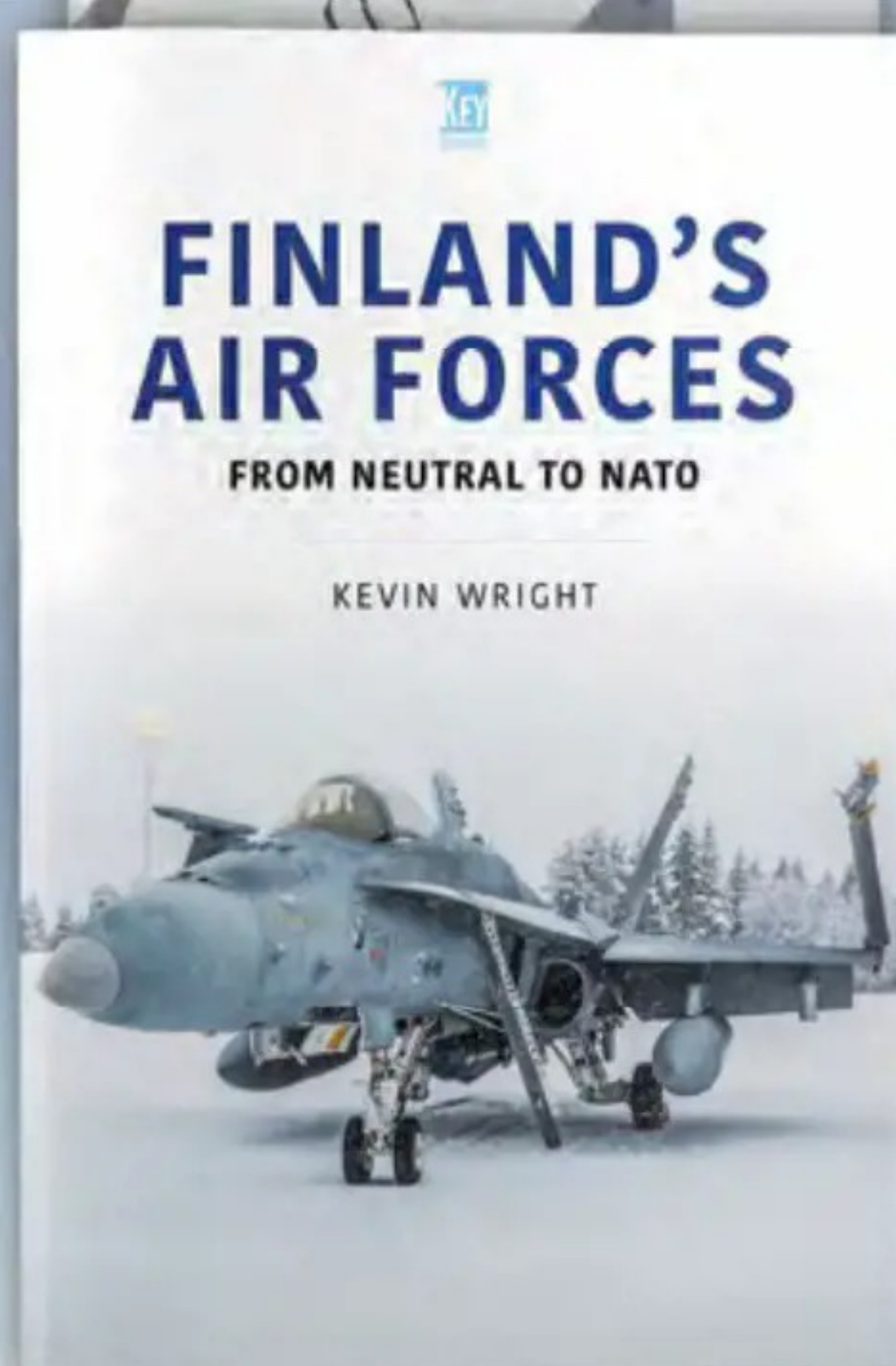
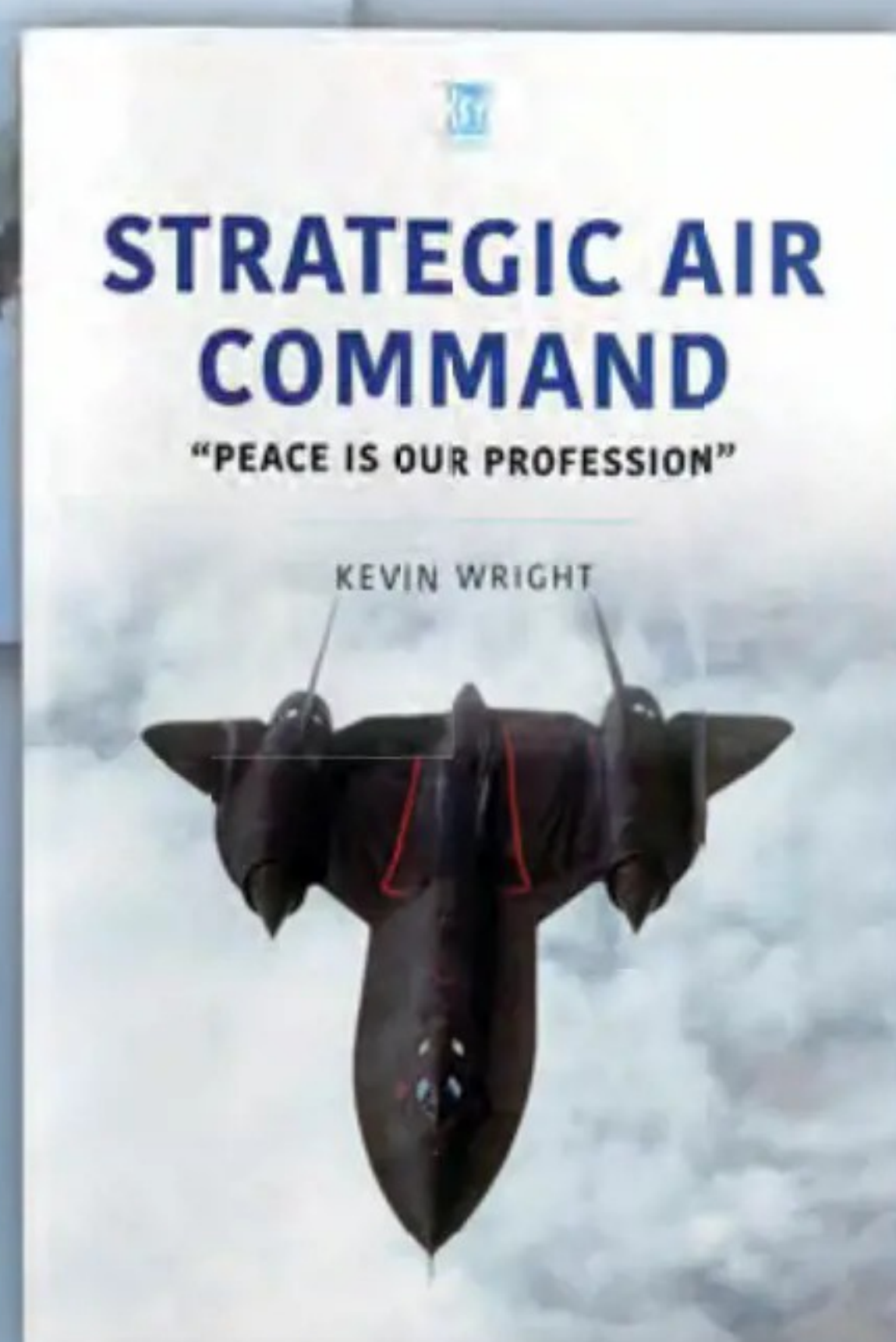


Col Hamid Reza Ranjbar, the test pilot of the Yasin-2 APT jet, who lost his life on December 4, 2024. He was a former F-5E/F pilot, instructor, and test pilot in the 41st TFS and 43rd CCTS, and then an F-5E Saeghe pilot at the 23rd TFS before becoming a test pilot with the IAMI Corporation in Shahin-Shahr Babak Taghvaei

APT jet was still ongoing, the IRIAF finalized a deal for 24 Yak-130 advanced training jets from Russia in the summer of 2022, with

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Pilot error caused USMC F-35B crash



A VMFAT-501 F-35B Lightning II during an airshow demonstration practice at Marine Corps Air Station Beaufort, South Carolina, on August 21, 2023
USMC/Lance Cpl Kyle Baskin

A COMMAND investigation into the loss of a US Marine Corps F-35B Lightning II mishap in South Carolina on September 17, 2023 (see *Attrition*, November 2023), has been completed by the 2nd Marine Aircraft Wing (MAW) investigating officer and endorsed by the commanding general of the 2nd MAW. Released on October 31, the report identifies the aircraft involved as 'side number BF-66', which is in fact the construction number. This makes it BuNo 169591, which at the time is believed to have been coded 'VM-66'. It was assigned to Marine Fighter Attack Training Squadron (VMFAT) 501 'Warlords', part of the 2nd MAW, based at Marine Corps Air Station Beaufort, South Carolina.

On the afternoon of September 17, 2023, this joint strike fighter crashed at Joint Base Charleston, South Carolina. The pilot safely ejected from the aircraft while attempting to execute a climb-out during a missed approach in instrument meteorological conditions and heavy precipitation. The aircraft continued to fly unmanned for 11 minutes and 21 seconds, before crashing in a rural area approximately 119km northeast of the airfield in Williamsburg County.

The Marine Corps thoroughly investigates all mishaps to identify the causes, learn from them and take action to reduce the chances of future mishaps. The investigation concluded that the mishap occurred due to pilot error. During a heavy rainstorm, the pilot incorrectly diagnosed an out-of-controlled-flight emergency, compounded by electrical and display malfunctions, and ejected from a flyable aircraft.

The investigation concluded that the pilot's decision to eject was ultimately inappropriate because commanded-flight inputs were in progress at the time of ejection, stand-by flight instrumentation was providing accurate data and the aircraft's back-up radio was at least partially functional. Furthermore, the aircraft continued to fly for an extended period after ejection.

Contributing factors to the mishap included an electrical event during flight, which induced failures of both primary radios, the transponder, the tactical air navigation system and the instrument landing system, together with the probability that the helmet-mounted and panoramic cockpit displays were not operational during at least

three distinct periods. This caused the pilot to become disoriented in challenging instrument and meteorological conditions. The electrical malfunction was not related to any maintenance activities. All preventive, scheduled and unscheduled maintenance conducted on the aircraft was correct and in keeping with established standards.

The pilot was qualified and current to conduct the scheduled flight. The flight was scheduled, planned, briefed and conducted properly, professionally and in accordance with applicable orders and directives. The forecast and observed weather at the time of the mishap supported the decision to land back at Joint Base Charleston.

The investigation concluded that the mishap aircraft's extended unmanned flight was due to stability provided by the F-35's advanced automatic flight-control systems. The loss of positive radar contact resulted from a failed transponder caused by the electrical malfunction and the aircraft's eventual descent below the air-traffic control radar horizon. The loss of positive contact could also be partially attributed to the F-35B's low-observable technology.

The crash site was located at approximately 1645hrs on September 18, 2023. Personnel with the US Navy Region Southeast On-Scene Coordinator team, Marine Corps Air Station Beaufort, Joint Base Charleston and the 2nd MAW conducted the aircraft recovery, environmental-clean-up and remediation efforts. Recovery and clean-up efforts began on September 19, 2023, with the goal for the impacted area to be free of contaminants and the conditions set for natural growth. Environmental remediation of the area included removal of affected crops, underbrush and trees to clear the wreckage and limit further environmental impacts. The government's environmental clean-up efforts were sufficient and in keeping with established procedures.

The Marine Corps said it was grateful to all Department of Defense, civilian and government agencies for their response, assistance, and continuing efforts.

Despite the investigation concluding that pilot error was the cause, the investigators recommended no punishment for the USMC pilot, whose name was redacted in the report.



Philippine Naval Air Wing AW109E Power, 432, seen here on April 19, 2015, during operations in the Philippine Sea, crashed on December 5, 2024, while landing at Cavite City-Danilo Atienza Air Base/Sangle Point Airport US Navy

D: Aug 19, 2010

N: Policía Nacional Paraguay

T: Robinson R44 Raven II

S: A-01

During a local flight from Asunción-Silvio Pettirossi International Airport the pilot attempted to land on uneven terrain in the San Bernardino area at 1110hrs local time but was unable to prevent the helicopter from rolling over. The main rotor blades and rotor shaft sustained substantial damage but the two crew were unhurt. The Robinson was subsequently repaired and returned to service, but suffered further accidents on January 24, 2012, and December 10, 2024 (see below right).

D: Dec 3, 2024

N: Argentine Army

T: SA.315B Lama

S: AE-390

While making an emergency landing at 1615hrs local time in Campo de los Angeles following a loss of engine power during a training flight prior to deployment of Task Force 65, part of the Argentinian contingent of the United Nations Peacekeeping Force in Cyprus. The Lama came down heavily, collapsing the skid undercarriage and bending

the rotor blades as they hit the ground, although the helicopter remained upright. All five of those on board (Lt Matías Garabuzo, Lt Juan García, 1st Corp Elías Samperez, Capt Santiago Rúa and 1st Lt Eliana Laiño) were injured.

D: Dec 4

N: Islamic Republic of Iran Air Force

T: HESA Yasin

While undertaking a routine test flight, this advanced jet trainer/light attack aircraft was destroyed when it crashed under unknown circumstances into a mountain

near Firuzabad, Fars province in southwest Iran. The two pilots, Col Hamid Reza Ranjbar and Col Manouchehr Pirzadeh, were killed.

D: Dec 5

N: Philippine Naval Air Wing/ Maritime Strike Helicopter Squadron 41

T: AW109E Power

S: 432

After returning from a third functional check flight from Cavite City-Danilo Atienza Air Base/Sangle Point Airport following its 400hr scheduled maintenance inspection, the helicopter crashed at approximately 1018hrs local time

while landing and was substantially damaged. The two pilots and three other occupants escaped with minor injuries. After the crash, the Navy temporarily grounded the type pending investigation.

D: Dec 8

N: Syrian Arab Republic Government

T: SA365 Dauphin II

S: YK-ALA

While parked at Mezzeh Air Base, Damascus, the airfield was overrun by Islamic insurgents following the collapse of the Bashar al-Assad government, resulting in the helicopter being spray painted



Policía Nacional Paraguay Robinson R44 Raven II, A-01, lies on its side with the boom broken away after a heavy landing on December 10 at Beterete Cué PNP

with graffiti and having its windows smashed. During the Israeli air strikes the following day (see below) a Gazelle parked close by was completely destroyed, but it is unknown whether the Dauphin suffered the same fate.

D: Dec 9
N: Syrian Arab Air Force
T: Multiple SA342L Gazelles
S: 1307, 1310, 1313, 1316, 1337, 1340, 1346, plus at least one more

Following the collapse of the Bashar al-Assad government in Syria, the Israeli Air Force undertook an air strike in Syria on Mezzeh Air Base, Damascus, to neutralise Syrian Air Force aircraft in order to prevent them falling into the hands of the insurgents that had taken over the country, thus posing a potential threat to Israeli security. These Gazelles were reported to be intact on December 8 when rebels took over the base, but images from the next day showed that they had been destroyed in the attack.

D: Dec 9
N: Syrian Arab Air Force
T: Various

In addition to the already mentioned attack on Mezzah (see above), a large number of other Syrian military targets were struck by Israeli air strikes, including Qamishli Air Base in northeast Syria, Shinshar in Homs, Aqrba Airport, southwest of Damascus, and Qabr Essit Airport, south of Damascus. The last of these is a civilian airfield where some military helicopters had fled. It is almost certain that there were aircraft losses at some or all of these airfields, but details are as yet unknown.

D: Dec 9
N: Turkish Land Forces/Army Aviation School
T: UH-1H Iroquois

After departing from Isparta-Süleyman Demirel Airport with a second helicopter on a training flight, this ‘Huey’ collided with the second example at around 1100hrs local time over the Keçiborlu district, Isparta. The Iroquois crashed in an open field and was destroyed, killing five of the six on board, while the sixth was seriously injured. The second helicopter landed safely.

D: Dec 9
N: US Air Force
T: MQ-9A Reaper

This UAV crashed in an area controlled by Syrian Democratic Forces (SDF) near Tell Tamer, Al-Hasakah Governorate, Syria.



Turkish Air Force TAI Aksungur (Anka-2) shot down by Kurdish forces near Al-Dirbasiyah, in the Ras al-Ayn District of Al-Hasakah Governorate, Syria, on December 10 Via X

Images released by the SDF show it upright with its propeller partially destroyed, suggesting it came down in a relatively level attitude and may have merely had engine failure, rather than being shot down.

D: Dec 10
N: Policía Nacional Paraguay
T: Robinson R44 Raven II
S: A-01

While in flight, the pilot noticed low rotor RPM and attempted to make an emergency landing at around 1600hrs local time in an open area at Beterete Cué. However, the helicopter came down heavily, causing the main rotor to sever the tail boom, following which it rolled over onto its port side and was extensively damaged. The three crew members – non-commissioned officers Miguel Del Valle, Oscar Vásquez and Elvis Serván – escaped with minor injuries. This same helicopter had been damaged in two previous accidents, on August 19, 2010 (see above) and January 24, 2012 (see *Attrition*, June 2012).

D: Dec 10
N: Turkish Air Force
T: TAI Aksungur (Anka-2)

Kurdish forces shot down and destroyed this UAV near Al-Dirbasiyah, in the Ras al-Ayn District of Al-Hasakah Governorate, Syria.

D: Dec 12
N: Chinese Ministry of Emergency Management
T: Wing Loong 2H

During a test flight, this large UAV collided at 1109hrs local time with a crane on top of a high-rise residential building near Shashi Airport in Jiungzhou City, Hubei Province. The impact caused the starboard wing to break off, resulting in loss of control and causing the UAV to crash near

the Olympic Sports Centre. The UAV burst into flames and was destroyed. It also started a ground fire that injured one person.

D: Dec 14
N: Russian Air Force/790th IAP
T: Su-27P Flanker
S: 16 Red/RF-02496

A saboteur set a fire under the belly of the aircraft while it was parked at Krymsk Air Base, Krasnodar Krai, Russia. The fire then spread and, although precise details are unconfirmed, it is reported that damage was such that the aircraft will be written off.

D: Dec 14
N: Ukrainian Air Force/299th Tactical Aviation Brigade
T: Su-25 Frogfoot
S: 27 Blue

While undertaking a close air support mission in Russia’s Kherson Oblast, this aircraft was shot down by a Russian S-400 Triumf (SA-21 *Growler*) air defence system. coming down at 1243hrs local time near the R-47 highway north of Kherson. The Ukrainian Air Force confirmed the loss and that the pilot had been killed.

D: Dec 15
N: Ukrainian Main Directorate of Intelligence
T: Aeroprakt A-22 Foxbat (modified)

This light sport aircraft, modified into an unmanned attack configuration, was destroyed when it crashed and exploded on impact with a target in a built-up area of Grozny, Chechnya.

D: Dec 15
N: Argentine Air Force
T: Beech B-45 Mentor
S: E-034

While taxiing at Aeródromo de Escobar, the aircraft’s nose undercarriage collapsed, resulting in damage to the propeller and engine. The pilot was unhurt. The aircraft was one of three operated by the Argentine Air Force as a commemorative squadron and participating in the Escobar Vuela 2024 airshow.

Additional material from:
Scramble/Dutch Aviation Society and Asagiri Yohko.



Wreckage of the Chinese Ministry of Emergency Management Wing Loong 2H which crashed near Shashi Airport in Jiungzhou City, Hubei Province, China, on December 12 Via X

A Turkish Air Force F-16C/D from 151 Filo 'Kurtlar' (Wolves) flies a mission over Turkey
Cem Dogut



• Crest of a wave

Khaleem Chapman looks at what 2025 holds for Britain's two aircraft Carriers, HMS *Queen Elizabeth* and HMS *Prince of Wales*, their missions and the squadrons deployed aboard

• International rescue

Marco Muntz and Marnix Sap report from the annual exercise Grifone in Tuscany as Italy hosted a number of nations to practice search and rescue operations and hone vital aerial lifesaving skills

• Selling surveillance

Contractors are increasingly growing "private air forces" to support military functions; subsequently, they have landed at the epicentre of Intelligence, Surveillance and Reconnaissance operations. Luca Chadwick investigates this clandestine world

Armed and ready

NEXT ISSUE

The March issue is
on sale from February
20, 2025

Cem Dogut takes a detailed look at the Turkish Air Force's F-16 fleet, its squadrons and variants, and what's ahead for their Fighting Falcons.



An RAF F-35B from 617 Squadron 'Dambusters' takes off from the deck of HMS Prince of Wales
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